

# **SOIL SURVEY OF Lebanon County, Pennsylvania**



**United States Department of Agriculture  
Soil Conservation Service  
in cooperation with the  
Pennsylvania State University, College of Agriculture, and the  
Pennsylvania Department of Environmental Resources  
State Conservation Commission**



# How To Use This Soil Survey

## General Soil Map

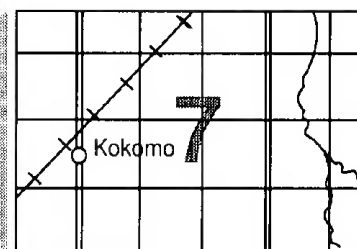
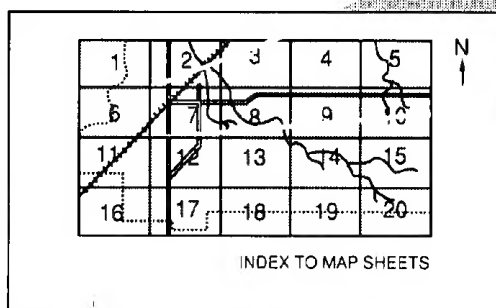
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

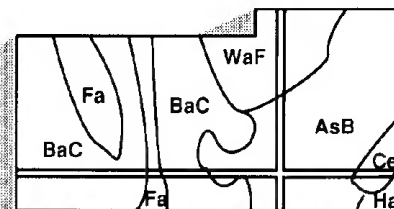
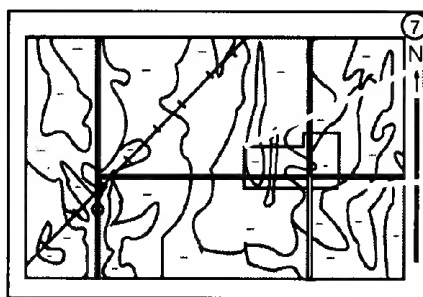
## Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1967-1974. Soil names and descriptions were approved in 1976. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1977. This survey was made cooperatively by the Soil Conservation Service; The Pennsylvania State University, College of Agriculture; and the Pennsylvania Department of Environmental Resources, State Conservation Commission. It is part of the technical assistance furnished to the Lebanon County Conservation District. Financial assistance was provided by the Lebanon County Board of Commissioners and by the Department of Housing and Urban Development, under provisions of Section 701 of the Housing Act of 1954, as amended.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

**Cover: Cultivated area of Laldig channery loam, 3 to 8 percent slopes. Woodland in background is Laldig extremely stony loam, 8 to 25 percent slopes.**



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## Foreword

It is my pleasure to present the soil survey of Lebanon County. In this report you will find information useful for land planning programs. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

This soil survey has been prepared for many users. Planners, community leaders, engineers, developers, builders, and home buyers can use it to plan land use, select sites for construction, pinpoint areas where potential soil problems are likely to occur, develop soil resources, and identify any special practices that may be needed to assure proper performance.

Farmers and woodland owners can use this survey to estimate crop potential and determine land improvement practices. Landscape architects and gardeners can use it to determine the potential of the soil for shrubs, ornamentals, shade trees, lawn grasses, flowers, and vegetable gardens. Conservationists, recreationists, teachers, students, and specialists in wildlife management, waste disposal, and pollution control can use this survey to help understand and enhance the environment.

Great differences in soil often occur within very short distances. Some soils are continually or seasonally wet. Some are subject to flooding. Some soils are shallow to bedrock. Others are too unstable to be used as a foundation for buildings or roads. A high water table makes a soil poorly suited to basements and underground installations.

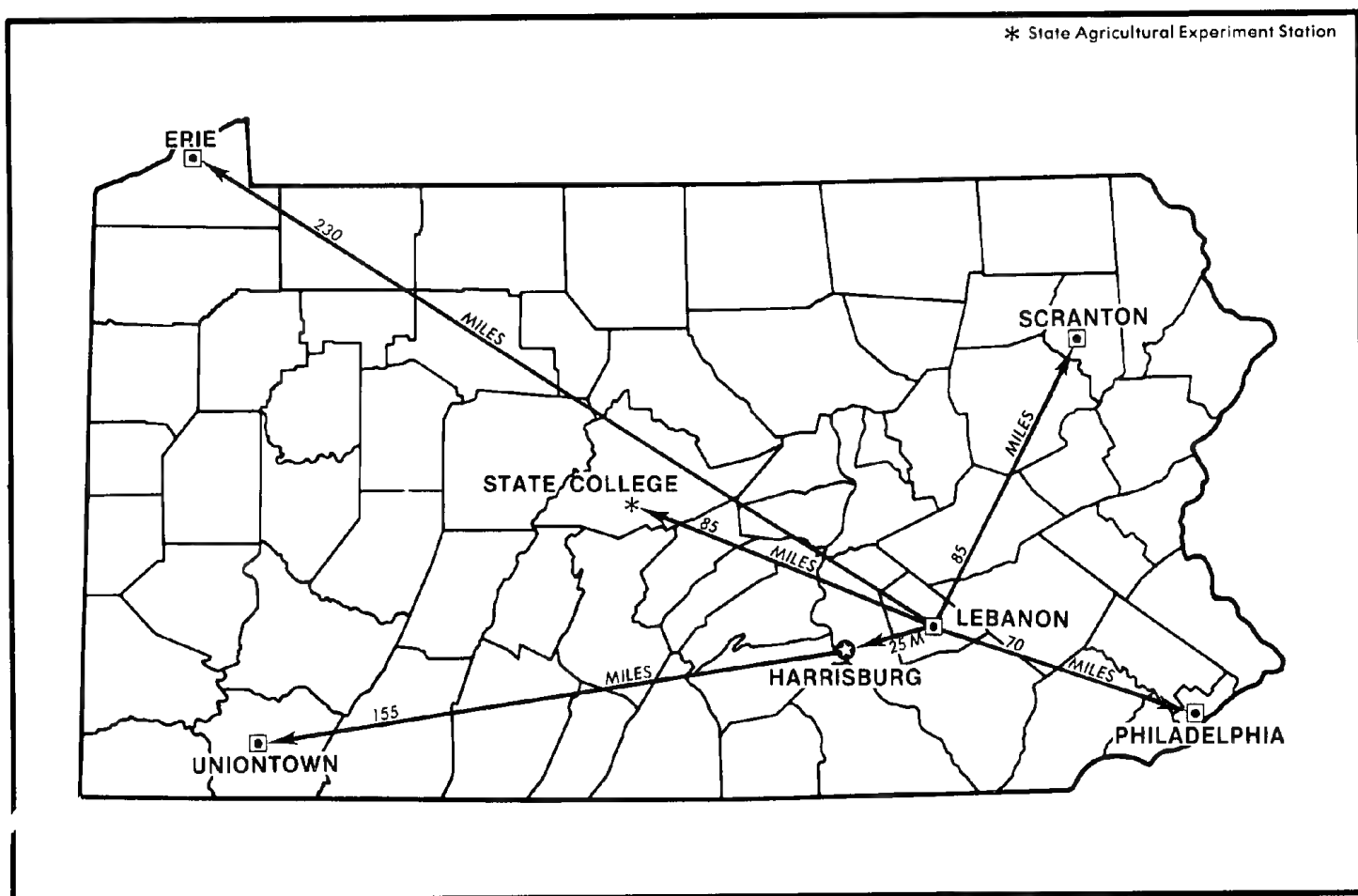
This report consists of two parts. The first part describes the potentials, hazards, and limitations of the soils. The second part is detailed maps showing the location of the soils.

It is impossible to explain all the ways this soil survey may be used. Additional information and assistance can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

I believe that the use of the information in this soil survey will help you to have a better environment and a better life. The widespread use of this information will greatly assist all of us in the conservation, development, and productive use of our soil, water, and related resources.



Graham T. Munkittrick  
State Conservationist  
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# SOIL SURVEY OF LEBANON COUNTY, PENNSYLVANIA

By Donald B. Holzer

Fieldwork by Donald B. Holzer and W. Merrill Kunkle, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with the Pennsylvania State University, College of Agriculture, and the Pennsylvania Department of Environmental Resources, State Conservation Commission

Lebanon County is in the southeastern part of Pennsylvania (see map on facing page). It is bordered on the west and northwest by Dauphin County, on the northeast by Schuylkill County, on the east by Berks County, and on the south by Lancaster County. The county has a total area of 363 square miles, or 232,320 acres. Its population in 1970 was 99,665. The city of Lebanon, population 28,572, and the borough of Palmyra, population 7,615, are the largest municipalities in the county.

The county is within 100 miles of several large metropolitan areas in the state. Philadelphia and Allentown are to the east, Scranton and Wilkes Barre to the north, Harrisburg to the west, and Lancaster to the south.

Dairy herds provide the main source of farm income. General farm crops and vegetables are of secondary importance. Hogs, chickens, and beef cattle are also important. The large acreage of productive soils in Lebanon County makes possible a high income from the sale of farm products.

The soils are of many different kinds. They formed in material weathered from limestone, shale, sandstone and conglomerate, diabase, and porcelanite. Most are suited to several different field crops and truck crops.

Factories that manufacture precision tools, steel, and machines; textile and packaging plants; medical facilities; insurance firms; and retail stores are the major sources of employment. Several hundred persons work in limestone quarries that provide road-building materials.

The Lebanon County Conservation District was organized in 1949.

## General nature of the county

This section gives general information about the county. It summarizes the history and development, geology, mineral resources, water, climate, and farming of the area.

## History and development

Susquehannas Indians first inhabited the Lebanon area. Indians of the Five Nations followed, and later the area was occupied by the Shawnee Indians.

Scotch-Irish settlers arrived about 1717. They were followed by Germans beginning about 1723. The main crops during this period were wheat and corn. Much of the wheat was furnished to the American Army during the Revolutionary War, and the area became known as the wheat granary of the country.

Lebanon County was formed in 1813 in an area that had been a township of Dauphin County. The city of Lebanon was named county seat.

The county gained industrial importance with the discovery of the iron ore magnetite about 1737. This deposit proved to be one of the most valuable in the United States, and it was mined until the ore was depleted in 1973.

In recent years other industries have become important in Lebanon County. They include garment manufacturing, alloy and steel casting, recreation, boilermaking, home and automobile fuel distribution, meat processing, printing, shoe manufacturing, limestone quarrying, banking, air pollution prevention, transportation, house construction, agricultural chemicals and fertilizers, and business and management forms industries. Government-related employment and associated facilities also bolster the local economy.

Transportation facilities have been an important factor in the development of industry. Today, Lebanon County is served by three interstate highways, three railroads lines, four small commercial airports, and one military airport.

The population increased from 81,603 in 1950 to 90,853 in 1960. The 1970 population of 99,665 consisted of a rural population of 51,672 and an urban population of 47,993.

## Geology

Bruce A. Benton, geologist, Soil Conservation Service, assisted in preparing this section.

Lebanon County lies almost entirely in the Valley and Ridge Province. The northern part of the county is in the Appalachian Mountain Section, and the central part is in the Great Valley Section. The southernmost part of the county lies in the Triassic Lowlands Section of the Piedmont Province.

In the Mountain Section, the bedrock is primarily Middle Paleozoic sandstone, shale, and conglomerate formations (5). The Great Valley Section, which covers nearly two-thirds of the central part of the county, has bedrock of Lower Paleozoic shale, limestone, and dolomite formations. The narrow Lowland Section in the southern part of the county is underlain by Triassic sandstone, conglomerate, and diabase. Pre-Cambrian granite gneiss is exposed in the southeast corner of the county.

Structurally, the geology is a very complex network of folds and faults caused by regional compression from the southeast during Late Paleozoic time. Sinkholes and solution cavities are common in the carbonate rocks in Lebanon Valley.

Topographically, the more weather-resistant sandstone and shale formations form the ridges and high valleys, and the less resistant dolomite and limestone formations form the low valley areas. Elevations range from over 1,600 feet above sea level on Second Mountain to less than 400 feet in the Lebanon Valley. These distinct and different topographic and geologic features influence soil development and use.

## Mineral resources

The diverse bedrock geology in Lebanon County has led to the development of many different mineral industries. Based on known mining operations of similar strata in other parts of Pennsylvania, there may be additional deposits in the county suitable for development.

The Middle Paleozoic sandstone and conglomerate beds in the Mountain Section are suitable for railroad ballast and building stone; the shales may have potential for brickmaking (6). Low-grade anthracite coal is mined to a small extent from the Pottsville Group.

The Lower Paleozoic rocks in the Great Valley Section have the largest mineral resources in the county. In the Jonestown area, the andesite lava deposits have been mined for building sand, and traprock (dark igneous rock) has been quarried for railroad ballast. The extensive Martinsburg shale has been quarried for roadfill and may have potential for brickmaking. Several quarries in the carbonate rocks are mined for concrete aggregate, road metal, cement, flux stone, lime, paint filler, railroad ballast, and other uses. The clay in the residual soil overlying the carbonate rocks could be used for brick and

pottery. In the past, anthracite coal was dredged from Swatara Creek.

Along the southern border in the Lowland Section, iron ore has been mined from the Triassic diabase intrusion. The Cornwall mines were important producers of high-grade ore until the 1972 flood forced them to close because of high water. Associated reserves of gold, copper, cobalt, nickel, and silver are also mined. The same diabase rock and surface boulders have potential uses as railroad ballast and road metal. Triassic sandstone has been quarried for building stone. The red shales, which are used in other areas, may be suitable for brickmaking.

## Water

Bruce A. Benton, geologist, Soil Conservation Service, helped prepare this section.

Precipitation in Lebanon County averages 42 inches per year, primarily in the form of rainfall. Drainage is divided into the Susquehanna and Delaware River Basins. Most of the county lies in the Susquehanna River Basin in which the Swatara, Little Swatara, and Conewago Creeks are the principal streams. A small area in the southeast corner of the county is drained by the Tulpehocken Creek of the Delaware River Basin.

The main sources of water are dug and drilled wells, springs, and storage reservoirs. Rural areas are served by wells; urban areas are served by surface water storage reservoirs, and supplemented by drilled wells and springs.

Ground water storage, movement, and yields vary throughout the county. This variation depends on the size and extent of bedding planes, joints, fractures, and solution cavities, and the interconnection between these features (3). The best yields are in ground water troughs which are commonly parallel to stream channels.

Ground water recharge throughout the county is derived from precipitation, and, in the carbonate area, the greatest accumulation of runoff occurs at sinkholes and dry streams.

Although yields vary widely, the most productive aquifers are in Cambrian and Ordovician formations of predominantly limestone and dolomite. The least productive wells in the carbonate rock area are in formations of thin-bedded limestone and dolomite and thick- to thin-bedded, oolitic dolomite.

The ground water in the carbonate rock area can be hard as a result of high concentrations of minerals or contaminated as a result of variable concentrations of nitrates (4). Ground water contamination from uncontrolled sewage and contaminated surface water is always a potential hazard in carbonate rocks where there is easy access through sinkholes and solution channels.

Generally, hard water and low yields have been experienced in the Martinsburg shale area. The Triassic sand-

stone, conglomerate, and shale formations yield small quantities of good water. The Pre-Cambrian and Triassic crystalline rocks are poor water-bearing formations. Except for a few formations, most of the Middle Paleozoic rock in the Mountain Section gives moderate to good yields of good water.

## Climate

Lebanon County is in the Southeastern Piedmont Climatological Division of Pennsylvania. Second Mountain rises to 1,500 feet along the northern border of the county; South Mountain along the southern border has an elevation of 1,000 feet. These border areas are the highest in the county.

The climate is humid continental. Most weather systems that affect the county develop in the central United States and are modified considerably before reaching Lebanon County. Another influence is the Atlantic Ocean. These factors combine to produce extremes only when the county is affected by unusually strong weather systems.

Table 1 gives data on temperature and precipitation as recorded at the city of Lebanon for the period 1941-70. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring.

The average annual precipitation of 42.30 inches is distributed throughout the year; however, the winter season usually receives slightly less than the other seasons. The heaviest one-day rainfall during the period of record was 5.72 inches on August 23, 1933.

In summer, 60 percent of the possible sunshine is received. High temperatures reach the mid-80's, and clear nights have pleasant temperatures near 60 degrees F. Extended periods of hot and humid weather occur with temperatures hotter than 90 degrees F on an average of 25 days a year. A record high of 106 degrees F was recorded in August 1918. Cold frontal passages are infrequent and difficult to ascertain because of the modification which takes place before an airmass reaches the county. If a change in airmass is noted, it is of short duration. Temperatures seldom drop below 40 degrees in summer, but have occurred under the influence of an extremely cold airmass. The prevailing wind direction in the summer is west-southwest. Summer rainfall is adequate, usually falling as afternoon or evening showers or thunderstorms. There are about 37 thunderstorms each year, and most occur in summer.

Winters are cold, but cloudiness is not persistent because of the moisture lost in the more western counties as the airmasses approach. Daytime maximum temperatures average in the upper 30's; nighttime minimum temperatures drop into the low 20's. Seventy-degree temperatures, although recorded, are rare. Subzero temperatures occur about twice a year. Moderately heavy snows have occurred in November, but the first significant snowfall is usually in December. The last snowfall nor-

mally occurs in March. Heavy snows are generally associated with low pressure disturbances which move from the Mississippi Valley into southern Pennsylvania or lows which form off the Carolina coast and move northeastward. The average annual snowfall is about 27 inches; however, the record monthly snowfall is 36 inches. Snow cover of an inch or more occurs on an average of 18 days in January. Average windspeed is highest, 12 miles per hour, in winter, when the prevailing wind is from the northwest.

Spring and fall are transition periods. Temperatures become more summerlike in April, and the average daily maximum in the 60's indicates a shift to the summer season. October is pleasant, with daytime highs in the 60's.

The average growing season for Lebanon is 176 days. The average date of the last spring freeze is April 23, and the first fall freeze occurs on October 16.

The mountainous areas of the county generally have cooler mean temperatures (approximately 3-4 degrees lower), have a shorter growing season, and receive slightly more precipitation than Lebanon.

## Farming

In the past few years in Lebanon County, the number of farms, the average size of the farms, and the total acreage of farmland have decreased. According to the U.S. Census of Agriculture, in 1969 there were 992 farms in the county, and the average farm size was 116 acres. By 1974, the number of farms had decreased to 974 and the average size to 113 acres. The total acreage of farmland decreased from 115,495 acres in 1969 to 109,637 acres in 1974.

The principal crop yields in 1974 were: corn for grain, 1,817,000 bushels; corn for silage; 180,500 tons; wheat, 352,600 bushels; oats, 259,700 bushels; barley, 300,000 bushels; and hay, 76,900 tons.

The number of cattle and calves increased from 47,600 in 1973 to 50,600 in 1974. Other livestock in 1974 included 1,000 sheep and lambs, 2,473,000 broilers and 357,600 hens, and 19,100 hogs and pigs.

## How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it ex-

tends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information is then organized and published so that it is readily available to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

## General soil map for broad land use planning

The general soil map at the back of this publication shows, in color, map units that have a distinct pattern of soils and of relief and drainage. Each map unit is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is

named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

### 1. Hagerstown-Duffield-Clarksburg

*Deep, nearly level to moderately steep, well drained and moderately well drained soils in limestone valleys (fig. 1)*

This map unit, the largest, covers about 29 percent of the county. It is on broad plains and tops, benches, and side slopes and foot slopes of low limestone ridges in broad valleys in the south-central part. The soils formed in residuum and colluvium from limestone with some sandstone and shale.

Hagerstown soils are deep and well drained and make up about 35 percent of this unit. Duffield soils are deep and well drained and make up about 31 percent. Clarksburg soils are deep and moderately well drained and make up about 13 percent. The remaining 21 percent of this unit includes Thorndale soils, Urban land, and Rock outcrop in the uplands and Melvin Variant, Nolin Variant, and Lindside soils on flood plains.

The unit is dominantly used for crops, hay, and pasture. Other uses are limestone quarrying and urban and industrial development. The soils in this unit are among the best in the county for agriculture if management practices are adequate to control erosion and conserve water. Major limitations for most other uses are sinkholes, solution channels and caverns in the bedrock, and a seasonal high water table and, in the steeper areas, slopes. Ground water contamination is a hazard for many uses because of the caverns and solution channels in the bedrock.

### 2. Berks-Weikert-Bedington

*Shallow to deep, nearly level to very steep, well drained soils on uplands*

This map unit covers about 22 percent of the county. It is on convex tops, side slopes, and foot slopes of dissected ridges and hills in the west-central and north-

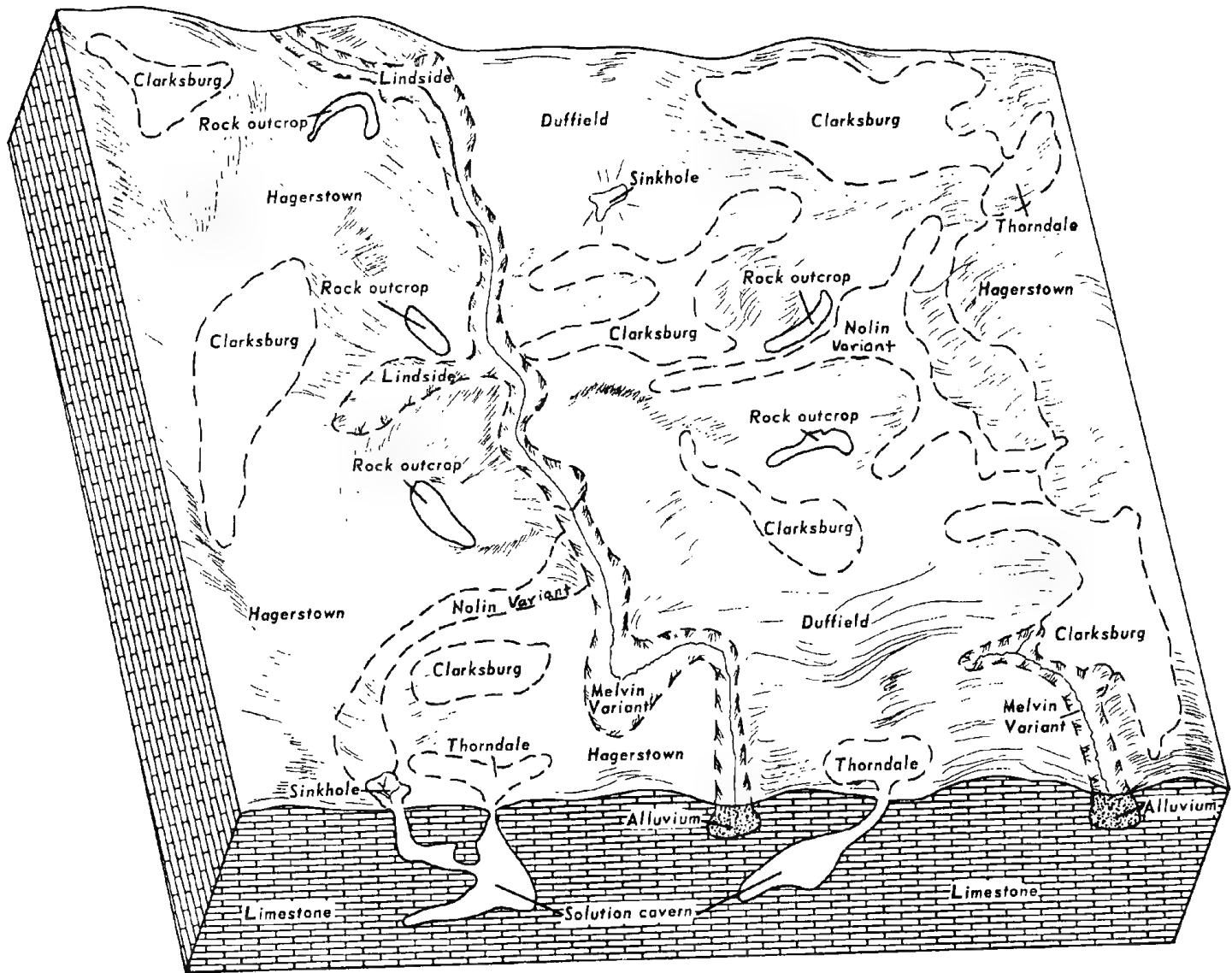


Figure 1.—Pattern of soils in the Hagerstown-Duffield-Clarksburg general soil map unit.

ern part. The soils formed in residuum from acid shale, sandstone, and siltstone.

Berks soils are moderately deep and well drained and make up about 30 percent of this unit. Weikert soils are shallow and well drained and make up about 20 percent. Bedington soils are deep and well drained and make up about 12 percent. The remaining 38 percent includes Comly, Brinkerton, and Klinesville soils in the uplands and Holly, Philo, Markes, and Pope soils on flood plains.

The unit is dominantly used for hay and pasture. Other uses are crops, woodland, and urban development. A

small part of this unit is in the Edward Martin Military Reservation. If management practices are adequate to conserve moisture and control erosion, this unit is fairly suited to most agricultural uses. Shallow to moderate depth to bedrock, slope, and limited available water are the major soil limitations for most uses.

### 3. Laidig-Hazleton-Leck Kill

*Deep, nearly level to very steep, well drained soils on mountains, ridges, and summits*

This map unit covers about 16 percent of the county. It is on tops, side slopes and foot slopes of mountains, summits, and dissected ridges in the northern part. The soils formed in residuum and colluvium from acid sandstone and shale.

Laidig soils are deep and well drained and have a fragipan. They make up about 38 percent of this unit. Hazleton soils are deep and well drained and make up about 27 percent. Leck Kill soils are deep and well drained and make up about 11 percent. The remaining 24 percent includes Buchanan, Ungers, Abbottstown, and Weikert soils and the miscellaneous area Rubble land in the uplands and Holly soils on flood plains.

The unit is dominantly used for woodland. Most areas are too stony and steep for cultivation, but small areas on foot slopes and in valleys have been cleared and are used for crops, hay, and pasture. A few small areas are used for urban and recreational development. Most of the State-owned gamelands and part of Edward Martin Military Reservation are in this unit. Areas that are not stony are suited to most agricultural uses if management practices are adequate to control erosion and conserve water. Surface stones, slow permeability, and slope are the major limitations for most uses.

#### 4. Ungers-Neshaminy-Watchung

*Deep, nearly level to very steep, well drained and poorly drained soils on mountains and ridges*

This map unit covers about 14 percent of the county. It is on tops, on side slopes, on foot slopes, on flats, and in depressions of mountains and ridges in the southern part. The soils formed in residuum and colluvium from conglomerate, sandstone, siltstone, diabase, and other dark basic rock.

Ungers soils are deep and well drained and make up about 47 percent of this unit. Neshaminy soils are deep and well drained and make up about 21 percent. Watchung soils are deep and poorly drained and make up about 5 percent. The remaining 27 percent includes Brecknock, Mount Lucas, Abbottstown, Bucks, Readington, and Lehigh soils in the uplands and Holly, Bownmansville, and Lindsides soils on the flood plains.

The unit is dominantly used for woodland. Most areas are too stony and too steep for cultivation, but some foot slopes have been cleared for crops, hay, and pasture. Other uses include urban development and wildlife refuge. About 12 percent of the State-owned gamelands in the county are in this unit. Large private holdings of the iron-ore mining industry are also in this unit. Areas that are not stony are suited to most agricultural uses if management practices are adequate to control erosion and conserve water. Surface stones, slope, and high water table are the major limitations for most uses.

#### 5. Bedington-Berks-Holly

*Deep and moderately deep, nearly level to moderately steep, well drained and very poorly drained to poorly drained soils on uplands and flood plains (fig. 2)*

This map unit covers about 11 percent of the county. It is in the east-central part, on the tops, side slopes, and foot slopes of broad hills and dissected ridges on flood plains. The soils formed in residuum from acid shale and sandstone and in alluvium.

Bedington soils are deep and well drained and make up about 41 percent of this unit. Berks soils are moderately deep and well drained and make up about 38 percent. Holly soils are deep and very poorly drained to poorly drained and make up about 4 percent. The remaining 17 percent includes Weikert, Comly, Brinkerton, and Klinesville soils on uplands and Pope and Philo soils on flood plains.

The unit is used dominantly for crops and hay. Most other areas are used for woodland and urban development. The unit is suited to agricultural uses if management practices are adequate to control erosion and conserve moisture. Moderate depth to rock, limited available water capacity, high water table, and flooding are the major limitations for most other uses.

#### 6. Neshaminy-Berks-Holly

*Deep and moderately deep, nearly level to very steep, well drained and poorly drained to very poorly drained soils on uplands and flood plains*

This map unit covers about 3 percent of the county. It is in the central part, on tops and side slopes of hills and dissected ridges and on nearby flood plains. The soils formed in residuum from diabase and other dark basic rocks and highly fractured acid shale and siltstone and in alluvium.

Neshaminy soils are deep and well drained and make up about 59 percent of this unit. Berks soils are moderately deep and well drained and make up about 13 percent. Holly soils are deep and poorly drained to very poorly drained and make up about 6 percent. The remaining 22 percent includes Bedington, Comly, Mount Lucas, and Brinkerton soils on uplands and Philo and Pope soils on flood plains.

The unit is dominantly used for crops, hay, pasture, and woodland. Other uses include urban development and rock quarrying. The stony and steeper areas are confined to woodland. The areas that are not stony are suited to agricultural uses if management practices are adequate to control erosion and conserve moisture. Moderate depth to rock, limited available water, slope, stoniness, high water table, and flooding are limitations for most uses.

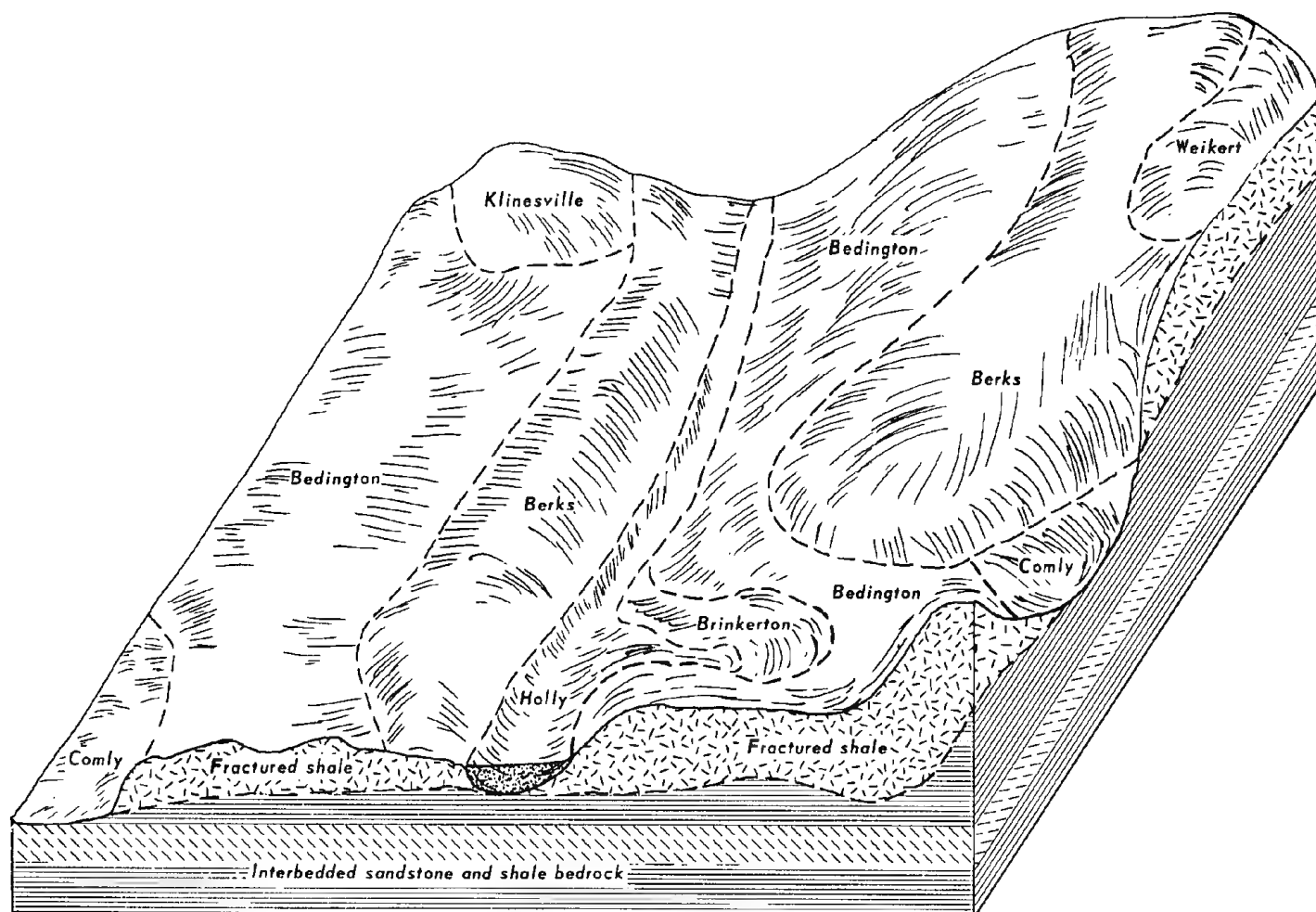


Figure 2.—Pattern of soils in the Bedington-Berks-Holly general soil map unit

## 7. Chester-Murrill-Hazleton

*Deep, nearly level to very steep, well drained soils on mountains, ridges, and benches*

This map unit covers about 3 percent of the county. It is in the southeastern part, on tops, side slopes, and foot slopes of mountains, summits, and ridges and on related fans and benches. The soils formed in residuum and colluvium from mica, schist, gneiss, acid sandstone and shale, and impure limestone.

Chester soils are deep and well drained and make up about 46 percent of this unit. Murrill soils are deep and well drained and make up about 17 percent. Hazleton soils are deep and well drained and make up about 9 percent. The remaining 28 percent includes Laidig, Buchanan, and Ungers soils in the uplands and Holly and Rowland soils on the flood plains.

The unit is dominantly used for woodland. About two-thirds of the acreage is too stony for cultivation. Some areas are used for crops, hay, and pasture, and some small areas are used for urban development and rock quarrying. A small part of the unit is State-owned game-lands. Areas that are not stony are suited to agricultural uses if management practices are adequate to control erosion. Surface stones and slope are the major limitations for most uses. In areas where impure limestone is prevalent, sinkholes and solution channels are potential hazards.

## 8. Bucks-Penn-Bowmansville

*Deep and moderately deep, nearly level to sloping, well drained and poorly drained to somewhat poorly drained soils on uplands and flood plains*



This map unit covers about 2 percent of the county. It is in the southwestern part, on nearly smooth to rolling dissected hills and ridges and nearly level flood plains. The soils formed in residuum from triassic fine-grained sandstone and shale in alluvium.

Bucks soils are deep and well drained and make up about 26 percent of this unit. Penn soils are moderately deep and well drained and make up about 21 percent. Bowmansville soils are deep and poorly drained to somewhat poorly drained and make up about 13 percent. The remaining 40 percent includes Abbottstown, Readington, Brinkerton, and Brecknock soils in uplands and Lindsides soils on flood plains.

The unit is used dominantly for crops, hay, and pasture. A few areas are used for woodland and urban development. The unit is suited to agricultural uses if management practices are adequate to control erosion and conserve water. The Bucks soils are among the best soils in the county for this use. Depth to bedrock, slope, flooding, and seasonal high water table are the major limitations for most uses.

## Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

This survey has both narrowly defined and broadly defined map units. The composition of the broadly defined units is more variable than that of the others, but has been controlled well enough to allow interpretations for the expected uses. Broadly defined units are indicated by symbols in which all of the letters are capitals. HHB is an example.

Each map unit on the detailed soil maps represents an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have profiles that are almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all

the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Hazleton series, for example, was named for the town of Hazleton in Luzerne County.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Hazleton extremely stony sandy loam, gently sloping, is one of several phases within the Hazleton series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes, soil associations, and undifferentiated groups.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportions are somewhat similar in all areas. Hagerstown-Rock outcrop complex, 3 to 8 percent slopes, is an example.

A *soil association* is made up of soils that are geographically associated and are shown as one unit on the map because it is not practical to separate them. A soil association has considerable regularity in geographic pattern and in the kinds of soil that are a part of it. The extent of the soils can differ appreciably from one delineation to another; nevertheless, interpretations can be made for use and management of the soils. Hazleton-Laidig association, moderately steep, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Ungers and Calvin soils, steep, is an undifferentiated group in this survey area.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Quarries is an example. Some of these areas are too small to



be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 3, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

## Soil descriptions

**AbA—Abbottstown silt loam, 0 to 3 percent slopes.** This nearly level, deep, somewhat poorly drained soil is on broad flats, in small depressions, and in drainageways between higher convex slopes and areas bordering streams in upland valleys. The areas vary in shape and are about 3 to 50 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches. It is friable to firm, mottled, reddish brown and dark reddish brown silt loam and silty clay loam to a depth of 20 inches. A very firm and brittle fragipan is at a depth of 20 inches. It is mottled, reddish brown and dark reddish gray silt clay loam to a depth of 42 inches. Below that is friable, weak red shaly silty clay loam. Bedrock of weak red fractured shale is at a depth of 60 inches.

Included in mapping are small areas of Brinkerton and Readington soils, gently sloping areas, spring seeps, and intermittent streams.

This somewhat poorly drained soil has slow permeability and moderate available water capacity. Surface runoff is slow. The root zone is limited by the fragipan.

In unlimed areas, this soil is extremely acid to strongly acid in the surface layer and upper part of the subsoil and strongly acid to slightly acid in the lower part of the subsoil. This soil is used mainly for cultivated crops, pasture, and hay. A few areas are used for homesites and trees. This soil is suited to cultivated crops, hay, pasture, and woodland. It has limitations for many nonfarm uses.

When this soil is cultivated, there is a slight hazard of erosion. Crops respond well to fertilizer and good management. Open and closed drains are needed to remove excess water and allow timely tillage. Diversions may be needed to intercept runoff from higher elevations. Incorporating crop residues and manure into the surface layer and including grasses and legumes in the cropping system are ways of maintaining organic matter content and good tilth.

This soil is suited to pasture. Overgrazing or grazing on this soil when it is wet are major concerns of management. If the pasture is grazed when the soil is wet, the surface layer will become compacted and the structure destroyed. Proper stocking rates and rotation of

pastures will prevent overgrazing and help maintain key plant species. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a very small acreage is wooded. Potential productivity is moderately high. Management problems are moderate. Machine planting is practical on the large areas.

This soil has severe limitations for most nonfarm uses because of slow permeability and the seasonal high water table. Buildings with basements should have foundation drains with proper outlets to prevent seepage into the basements. The capability subclass is IIIw; woodland ordination symbol is 3w.

**AbB—Abbottstown silt loam, 3 to 8 percent slopes.** This gently sloping, deep, somewhat poorly drained soil is in convex areas within the broad upland flats that are adjacent to or border narrow depressions and drainageways within the upland valleys. These areas vary in shape and are about 3 to 70 acres in size.

Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil extends to a depth of 60 inches. It is friable to firm, mottled, reddish brown and dark reddish brown silt loam and silty clay loam to a depth of 20 inches. A firm and brittle fragipan is at a depth of 20 inches. It is mottled, reddish brown and dark reddish gray silt clay loam to a depth of 42 inches. Below that is friable weak red shaly silty clay loam. Bedrock of weak red fractured shale is at a depth of 60 inches.

Included in mapping are small areas of Athol, Brinkerton, and Readington soils, nearly level areas, and spring seeps.

This somewhat poorly drained soil has slow permeability and moderate available water capacity. Surface runoff is medium to rapid. This soil has a seasonal high water table within 6 to 18 inches of the surface during wet seasons. The root zone is limited by the fragipan. In unlimed areas this soil is extremely acid to strongly acid in the surface layer and upper part of the subsoil and strongly acid to slightly acid in the lower part of the subsoil.

This soil is used mainly for cultivated crops, pasture, and hay. A few areas are used for homesites and trees. This soil is suited to farming, hay and pasture, and woodland. It has limitations for many nonfarm uses.

When this soil is cultivated, there is a moderate hazard of erosion. Crops respond well to fertilizer and good management. Runoff is reduced and erosion controlled by minimum tillage, strip cropping, diversions, and covered drains. Incorporating crop residues and manure into the surface layer and including grasses and legumes in the cropping system are ways of maintaining organic matter content and good tilth.

This soil is suited to pasture. Overgrazing or grazing when this soil is wet are major concerns of management. If the pasture is grazed when wet, the surface soil will

become compacted. Proper stocking rates and rotation of pastures will prevent overgrazing and help maintain key plant species. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a very small acreage is wooded. Potential is moderately high. Management problems are moderate. Machine planting is practical on the large areas.

This soil has serious limitations for most nonfarm uses because of slow permeability and the seasonal high water table, which are also serious limitations for onsite disposal of waste. Buildings with basements should have foundation drains with proper outlets to prevent wet basements. The capability subclass is IIIw; woodland ordination symbol is 3w.

**BeA—Bedington shaly silt loam, 0 to 3 percent slopes.** This nearly level, deep, well drained soil is on dissected uplands. Slopes are generally more than 100 feet in length and uniform. The areas are irregular in shape and 5 to 60 acres in size.

Typically, the surface layer is dark yellowish brown shaly silt loam about 9 inches thick. The subsoil extends to a depth of 48 inches. It is reddish brown shaly silty clay loam to a depth of 16 inches. The next layer is reddish brown shaly silty clay loam and yellowish red shaly heavy silt loam and very shaly silt loam to a depth of 35 inches. Below that is yellowish red very shaly silt loam to a depth of 48 inches. The substratum is red very shaly silt loam to a depth of 72 inches.

Included with this soil in mapping are a few areas of Comly soils, Berks soils, and scattered areas of Weikert and Klinesville soils.

This soil has moderate permeability and moderate available water capacity. Surface runoff is slow. The surface layer is 15 percent shale. In limed areas, reaction is neutral to slightly acid in the surface layer and upper part of the subsoil and strongly acid to very strongly acid in the lower part of the subsoil and in the substratum.

Most acreages are cultivated. Small areas are used for homesites and trees. The potential is good for farming; this soil is well suited to pasture and trees. The potential for homesites is good, but, in places, bedrock at a depth of 3 1/2 to 6 feet may present problems for onsite waste disposal. There are few limitations for most other nonfarm uses.

When this soil is cultivated, there is a slight hazard of erosion. Crops respond well to fertilizer and good management. Growing cover crops, utilizing crop residue, and including hay in the cropping system are ways of maintaining the organic matter content and good tilth. The shaly surface layer may interfere with the seeding of small grain and the mechanical harvesting of some crops, such as potatoes.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pas-

tures are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

The soil is suited to trees, but only a very small acreage is wooded. Potential productivity is high. Management problems are slight. Machine planting is practical on the large areas.

This soil has some limitations for nonfarm uses because of the moderate permeability and depth to bedrock in some places. The permeability and depth to bedrock in places are also limitations for onsite waste disposal. The capability class is I; woodland ordination symbol is 2o.

**BeB—Bedington shaly silt loam, 3 to 8 percent slopes.** This gently sloping, deep, well drained soil is on dissected uplands. Slopes are 800 to 1,000 feet long and undulating. The areas are irregular in shape and are mainly 5 to 600 acres in size.

Typically, the surface layer is dark yellowish brown shaly silt loam about 9 inches thick. The subsoil extends to a depth of 48 inches. It is reddish brown shaly silty clay loam to a depth of 16 inches. The next layer is reddish brown shaly silty clay loam and yellowish red shaly heavy silt loam and very shaly silt loam to a depth of 35 inches. Below that is yellowish red very shaly silt loam. The substratum, to a depth of 72 inches, is red very shaly silt loam.

Included with this soil in mapping are a few small areas of Comly and Berks soils. Small scattered areas of Weikert and Klinesville soils and spring seeps are also included.

This soil has moderate permeability and moderate available water capacity. Surface runoff is medium to rapid. The surface layer is 15 percent or more shale. In limed areas, reaction is neutral to slightly acid in the surface layer and upper part of the subsoil and strongly acid to very strongly acid in the lower part of the subsoil and in the substratum.

Most areas are cultivated. Small areas are used for homesites and trees. The potential is good for farming; this soil is well suited to pasture and trees. The potential for homesites is good, but the moderate permeability and bedrock at a depth of 3 1/2 to 6 feet may present problems for onsite waste disposal. This soil is good for most other nonfarm uses.

When this soil is cultivated, there is a moderate hazard of erosion. Crops respond well to fertilizer and good management. Stripcropping, minimum tillage, diversions, and sod waterways help control erosion. Growing cover crops, utilizing crop residue, and including grass in the cropping system are ways of maintaining the organic matter content and good tilth. The shaly surface layer may interfere with the seeding of small grain and the mechanical harvesting of some crops, such as potatoes.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pas-

ture are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a small acreage is wooded. Potential productivity is high. Management problems are slight. Machine planting is practical on the large areas.

This soil has some limitations for nonfarm uses because of the moderate permeability and depth to bedrock in places. The permeability and depth to bedrock in places are limitations for onsite waste disposal. The capability subclass is IIe; woodland ordination symbol is 2o.

**BeC—Bedington shaly silt loam, 8 to 15 percent slopes.** This sloping, deep, well drained soil is on dissected convex uplands. Slopes are 200 to 600 feet in length. The areas are irregular in shape and mainly 5 to 55 acres in size.

Typically, the surface layer is dark yellowish brown shaly silt loam about 9 inches thick. The subsoil extends to a depth of 48 inches. It is reddish brown shaly silty clay loam to a depth of 16 inches. The next layer is reddish brown shaly silty clay loam and yellowish red shaly heavy silt loam and very shaly silt loam to a depth of 35 inches. Below that is yellowish red very shaly silt loam. The substratum, to a depth of 72 inches, is red very shaly silt loam.

Included with this soil in mapping are a few small areas of Berks soils. Small, scattered areas of Weikert and Klinesville soils and spring seeps are also included.

This soil has moderate permeability and moderate available water capacity. Surface runoff is medium to rapid. The surface layer is 15 percent or more shale. In limed areas, reaction is neutral to slightly acid in the surface layer and upper part of the subsoil and strongly acid to very strongly acid in the lower part of the subsoil and in the substratum.

Most areas of this soil are cultivated. Small areas are used for homesites and trees. The potential is good for farming; this soil is well suited to pasture and trees. The potential for homesites is good, but the moderate permeability and bedrock at a depth of 3 1/2 to 6 feet may present problems for onsite waste disposal. This soil is good for most other nonfarm uses.

When this soil is cultivated, there is a severe hazard of erosion. Crops respond well to fertilizer and good management. Stripcropping, minimum tillage, diversions, and covered drains help control erosion. Growing cover crops, utilizing crop residue, and including grass in the cropping system are ways of maintaining the organic matter content and good tilth. The shaly surface layer may interfere with the seeding of small grain and the mechanical harvesting of some crops, such as potatoes.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pasture are the chief management needs. Optimum produc-

tion requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a small acreage is wooded. Potential productivity is high. Management problems are slight. Machine planting is practical on the large areas.

This soil has some limitations for nonfarm uses because of the moderate permeability and depth to bedrock in places. The permeability and depth to bedrock in places are limitations for onsite waste disposal. The capability subclass is IIle; woodland ordination symbol is 2o.

**BeD—Bedington shaly silt loam, 15 to 25 percent slopes.** This moderately steep, deep, well drained soil is on dissected convex uplands. Slopes are 500 to 700 feet in length. The areas are irregular in shape and mainly 5 to 50 acres in size.

Typically, the surface layer is dark yellowish brown shaly silt loam about 9 inches thick. The subsoil extends to a depth of 48 inches. It is reddish brown shaly silty clay loam to a depth of 16 inches. The next layer is reddish brown shaly silty clay loam and yellowish red shaly heavy silt loam and very shaly silt loam to a depth of 35 inches. Below that is yellowish red very shaly silt loam. The substratum, to a depth of 72 inches, is red very shaly silt loam.

Included with this soil in mapping are a few small areas of Berks soils. Small, scattered areas of Weikert and Klinesville soils and spring seeps are also included.

This soil has moderate permeability and moderate available water capacity. Surface runoff is rapid. The surface layer is 15 percent or more shale. In limed areas, reaction is neutral to slightly acid in the surface layer and upper part of the subsoil and strongly acid to very strongly acid in the lower part of the subsoil and in the substratum.

Most areas of this soil are within the Edward Martin Military Reservation. These areas are wooded or cleared. The other areas in the county are used for cultivated crops, hay and pasture, and homesites. The potential is fair for farming; this soil is suited to pasture and trees. The potential for most nonfarm uses is poor because of moderately steep slope.

When this soil is cultivated, there is a very severe hazard of erosion. Crops respond well to fertilizer and good management. Stripcropping, minimum tillage, and diversions can help control erosion. Growing cover crops, utilizing crop residue, and including hay in the cropping system are ways of maintaining the organic matter content and good tilth. The shaly surface layer may interfere with the seeding of small grain and the mechanical harvesting of some crops, such as potatoes.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pasture are the chief management needs. Optimum produc-

tion requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees. Potential productivity is high. Erosion needs to be controlled during harvesting.

This soil has some limitations for nonfarm uses because of moderately steep slope. Slope is a severe limitation for onsite waste disposal. The capability subclass is IVe; woodland ordination symbol is 2r.

**BkB—Berks shaly silt loam, 3 to 8 percent slopes.**

This gently sloping, moderately deep, well drained soil is on dissected uplands. Slopes are generally convex and dissected by drainageways, or they are uniform. They are 300 to 700 feet in length. The areas are irregular in shape and about 5 to 500 acres in size.

Typically, the surface layer is dark brown shaly silt loam about 9 inches thick. The subsoil extends to a depth of 28 inches. It is strong brown shaly silt loam to a depth of 15 inches. Below that it is strong brown very shaly silt loam. The substratum, to a depth of 33 inches, is yellowish brown, very shaly silt loam. Bedrock is at a depth of 33 inches.

Included with this soil in mapping are a few areas of Comly soils, Bedington soils, and scattered areas of Weikert and Klinesville soils.

This soil has moderate to rapid permeability and very low available water capacity. Surface runoff is medium. The surface layer is more than 20 percent shale. Plant rooting depth is restricted by the moderate depth to bedrock. In unlimed areas, reaction is very strongly acid or strongly acid in the surface layer and subsoil and very strongly acid to medium acid in the substratum.

Most of this soil is cultivated. Small areas are used for homesites and trees. The potential is fair for farming; this soil is suited to pasture and trees. The potential for homesites is fair, but the depth to bedrock will present problems for onsite waste disposal. This soil also has limitations for most other nonfarm uses.

If this soil is cultivated, the moderate hazard of erosion needs to be considered. Further erosion would result in a shallower rooting depth and lower available water capacity. Runoff can be reduced and erosion controlled by minimum tillage, constructing diversions, use of cover crops, and including grasses and legumes in the cropping system. Stripcropping can also be used where the topography is suitable. In places, bedrock hinders the construction of diversions. Incorporating some crop residue and manure into the surface layer will help maintain organic matter content and reduce the tendency of the soil to clod and crust.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pastures are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

A few acres of this soil are wooded. Potential productivity is moderately high but rooting depth is restricted by

shale bedrock. A major management problem is moderate seedling mortality because of the very low available water capacity. Machine planting is generally practical on the large areas.

This soil has limitations for most nonfarm uses because of the moderate depth to bedrock and moderate to rapid permeability. The moderate depth to underlying rock is a severe limitation for onsite disposal of waste. Excavating for buildings may also be a problem. When this soil is disturbed for construction, it is necessary to control erosion and sediment. The capability subclass is IIe; woodland ordination symbol is 3f.

**BkC—Berks shaly silt loam, 8 to 15 percent slopes.**

This sloping, moderately deep, well drained soil is on dissected uplands. Slopes are generally convex, about 300 to 700 feet in length, and dissected by drainageways. The areas are irregular in shape and about 5 to 80 acres in size.

Typically, the surface layer is dark brown shaly silt loam about 9 inches thick. The subsoil extends to a depth of 28 inches. It is strong brown shaly silt loam to a depth of 15 inches. Below that is strong brown, very shaly silt loam. The substratum, to a depth of 33 inches, is yellowish brown very shaly silt loam. Bedrock is at a depth of 33 inches.

Included with this soil in mapping are a few areas of Bedington, Weikert, and Klinesville soils and areas of a soil similar to Berks soils that has a sandy loam surface layer. Also included are areas of Berks soils on gentle slopes and spring seeps.

This soil has moderate to rapid permeability and very low available water capacity. Surface runoff is medium to rapid. The surface layer is more than 20 percent shale. Plant rooting depth is restricted by the moderate depth to bedrock. In unlimed areas, reaction is very strongly acid or strongly acid in the surface layer and very strongly acid to medium acid in the substratum.

Most of this soil is cultivated. Small areas are used for homesites and trees. The potential is fair for cultivated crops; this soil is suited to pasture and trees. The potential for homesites is fair, but the depth to bedrock will present problems for onsite waste disposal. The soil also has limitations for most other nonfarm uses.

If this soil is cultivated the severe hazard of erosion needs to be considered. Further erosion would result in a shallower rooting depth and lower available water capacity. Runoff can be reduced and erosion controlled by minimum tillage, constructing diversions, use of cover crops, and including grasses and legumes in the cropping system. Stripcropping can also be used where the topography is suitable. In places, bedrock hinders the construction of diversions. Incorporating some crop residue and manure into the surface layer will help maintain organic matter content and reduce the tendency of the soil to clod and crust.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pastures are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

A few acres of this soil are wooded. Potential productivity is moderately high, but rooting depth is restricted by shale bedrock. A major management problem is moderate seedling mortality because of the very low available water capacity. Machine planting is generally practical on large areas.

This soil has limitations for nonfarm uses because of the moderate depth to bedrock and moderate to rapid permeability. The moderate depth to underlying rock is a severe limitation for onsite disposal of waste. Excavating for buildings may also be a problem. When this soil is disturbed for construction, it is necessary to control erosion and sediment. The capability subclass is IIIe; woodland ordination symbol is 3f.

**BkD—Berks shaly silt loam, 15 to 25 percent slopes.** This moderately steep, moderately deep, well drained soil is on dissected uplands. Slopes are 200 to 600 feet in length and dissected by drainageways. The areas are elongated to broad and about 10 to 80 acres in size.

Typically, the surface layer is dark brown shaly silt loam about 9 inches thick. The subsoil extends to a depth of 28 inches. It is strong brown shaly silt loam to a depth of 15 inches. Below that is strong brown very shaly silt loam to a depth of 28 inches. The substratum, to a depth of 33 inches, is yellowish brown very shaly silt loam. Bedrock is at a depth of 33 inches.

Included with this soil in mapping are a few areas of Klinesville and Weikert soils. Also included are areas of a similar soil that has a sandy loam surface layer, areas of sloping Berks soils, spring seeps, and severely eroded areas.

This soil has moderate to rapid permeability and very low available water capacity. Surface runoff is rapid. The surface layer is more than 20 percent shale. Plant rooting depth is restricted by bedrock. In unlimed areas, reaction is very strongly acid or strongly acid in the surface layer and subsoil and very strongly acid to medium acid in the substratum.

Most of this soil is cultivated. Small areas are used for homesites and trees. The potential is poor to fair for cultivated crops because of the steepness of slope. This soil is better suited to pasture and trees. The potential for homesites is poor. Slope and the depth to bedrock are severe limitations for onsite waste disposal. Slope is also a limitation for most other nonfarm uses.

If this soil is cultivated, the severe hazard of erosion needs to be considered. Further erosion would result in a shallower rooting depth and lower available water capacity. Runoff can be reduced and erosion controlled by minimum tillage, constructing diversions, use of cover

crops, and including grasses and legumes in the cropping system. Stripcropping can also be used where the topography is suitable. In places, bedrock can hinder the construction of diversions. Incorporating some crop residue and manure into the surface layer will help to maintain organic matter content and reduce the tendency of the soil to clod and crust.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pastures are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

A few acres of this soil are wooded. Potential productivity is moderately high, but rooting depth is restricted by shale bedrock. A major management problem is moderate seedling mortality because of the very low available water capacity. Slope would interfere with machine planting and harvesting.

This soil has serious limitations for nonfarm uses because of moderate depth to bedrock, moderately steep slope, and moderate to rapid permeability. The slope and depth to underlying rock are serious limitations for the onsite disposal of waste. Excavating for buildings is also a problem. When this soil is disturbed for construction, erosion and sediment need to be controlled. The capability subclass is IVe; woodland ordination symbol is 3f.

**Bm—Bowmansville silt loam.** This nearly level, poorly drained and somewhat poorly drained soil is generally on narrow stream flood plains. The soil formed in alluvium washed from nearby uplands which are underlain by red triassic sandstone and siltstone or by dark basic rock. Slopes are smooth and slightly convex and range from less than 100 feet to 500 feet in length. Areas are irregular in shape and about 5 to 330 acres in size.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsoil is dark reddish brown, brown, and dark reddish gray silt loam to a depth of 40 inches. The substratum, to a depth of 60 inches, is stratified sand and gravel.

Included with this soil in mapping are intermingled areas of less than 2 acres in size of Bowmansville soils that have a loam, sandy loam, or gravelly surface layer. Also included are Rowland, Brinkerton, or Abbottstown soils.

The permeability is moderately slow above a depth of 40 inches and moderately rapid below that depth; the available water capacity is high. Surface runoff is slow. This soil is commonly flooded. Streambank erosion and gouging occur during floods. In unlimed areas, reaction is strongly acid to neutral. Depth to stratified sand and gravel is more than 40 inches.

The potential is fair for farming because of flooding and the seasonal high water table. Most of the acreage is woodland. Other areas are in pasture. This soil is limited for cultivated crops. It is limited for many urban

uses by flooding and the high water table. It is better suited to trees, pasture, and wildlife.

If adequately drained, this soil is fairly suited to cultivated crops. Wetness and flooding interfere with tillage. Crops respond well to fertilizer and good management, and incorporating manure and crop residue into the surface layer maintains organic matter content and good soil tilth. Surface drains and subsurface drains, where outlets are available, will improve drainage. Optimum production requires maintenance of fertility through periodic applications of nutrients.

The potential is fair for pasture. Overgrazing and grazing when the soil is wet are major concerns of management. If the pasture is grazed when wet, the surface layer will become compacted and soil structure destroyed. Rotation of pastures and proper stocking rates to maintain key plant species are ways to prevent overgrazing and maintain proper stocking rates. Deferred grazing during wet seasons will help keep the surface layer from becoming compacted.

This soil is suited to trees and has very high potential for production. Equipment limitation is a concern of management. The use of equipment is restricted for long periods during wet seasons and for short periods during flooding. Machine planting is practical on the larger areas.

This soil is limited for most urban uses because of flooding and the high water table. Flooding and wetness are serious limitations for homesites, onsite waste disposal, and most other nonfarm uses. The capability subclass is IIIw; woodland ordination symbol is 1w.

**BnB—Brecknock channery silt loam, 3 to 8 percent slopes.** This gently sloping, deep, well drained soil is on convex uplands. Slopes are generally 300 to 700 feet long and are smooth. The areas are irregular in shape and about 2 to 21 acres in size.

Typically, the surface layer is very dark grayish brown channery silt loam about 8 inches thick. The subsoil extends to a depth of 36 inches. It is friable, dark grayish brown silt loam to a depth of 20 inches. The next layer is firm, dark grayish brown heavy silt loam to a depth of 28 inches. Below that is firm, dark grayish brown channery silt loam. The substratum is firm very dark gray channery silt loam. Porcelanite bedrock is at a depth of 46 inches.

Included with this soil in mapping are a few areas of Neshaminy soils and Lehigh soils and scattered areas of sloping Brecknock soils.

This soil has moderate permeability and available water capacity. Surface runoff is slow to medium. The surface layer is 15 percent or more channery fragments. In unlimed areas, reaction is medium acid to very strongly acid in the subsoil and substratum.

Most of this soil is cultivated. Small areas are used for trees or homesites. The potential is good for farming; this soil is well suited to pasture and trees. The potential for homesites is good, but bedrock at a depth of 3 1/2

to 5 feet may present problems for onsite waste disposal. The channery surface is a limitation for many other nonfarm uses.

When this soil is cultivated, there is a moderate hazard of erosion. Crops respond well to fertilizer and good management. Growing cover crops, utilizing crop residue, and including hay in the cropping system are ways of maintaining the organic matter content and good tilth. Minimum tillage, diversions, and strip cropping control erosion. The channery surface may interfere with the seeding of small grain and the mechanical harvesting of some crops, such as potatoes.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pastures are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

The soil is suited to trees, but only a very small acreage is wooded. Potential productivity is moderate. Management problems are slight. Machine planting is practical on the large areas.

This soil has some limitations for nonfarm uses because of the channery surface, and the depth to bedrock may present problems for deep excavations and onsite waste disposal. The capability subclass is IIe; woodland ordination symbol is 4o.

**BnC—Brecknock channery silt loam, 8 to 15 percent slopes.** This sloping, deep, well drained soil is on convex upland side slopes. Slopes are generally 300 to 700 feet in length and are smooth. The areas are irregular in shape and are mainly about 2 to 57 acres in size.

Typically, the surface layer is very dark grayish brown channery silt loam about 8 inches thick. The subsoil extends to a depth of 36 inches. It is friable, dark grayish brown silt loam to a depth of 20 inches. The next layer is firm dark grayish brown heavy silt loam to a depth of 28 inches. Below that is firm, dark grayish brown channery silt loam. The substratum, to a depth of 46 inches, is firm, very dark gray channery silt loam. Porcelanite bedrock is at a depth of 46 inches.

Included with this soil in mapping are a few small areas of Neshaminy and Lehigh soils. Small, scattered areas of gently sloping Brecknock soils are also included.

This soil has moderate permeability and available water capacity. Surface runoff is medium to rapid. The surface layer is 15 percent or more channery fragments. In unlimed areas, reaction is medium acid to very strongly acid in the subsoil and substratum.

Most areas of this soil are cultivated. Small areas are used for trees or homesites. The potential is good for farming; this soil is well suited to pasture and trees. The potential for homesites is good, but the depth to bedrock may present problems for onsite waste disposal. The channery surface is a limitation for many other nonfarm uses.



When this soil is cultivated there is a severe hazard of erosion. Crops respond well to fertilizer and good management. Stripcropping, minimum tillage, diversions, and sod waterways help control erosion. Growing cover crops, utilizing crop residue, and including hay in the cropping system are ways of maintaining the organic matter content and good tilth. The channery surface may interfere with the seeding of small grain and the mechanical harvesting of some crops, such as potatoes.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pasture are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a small acreage is wooded. Potential productivity is moderate. Management problems are slight. Machine planting is practical on the large areas.

This soil has some limitations for nonfarm uses because of the channery surface, and the depth to bedrock may present problems for deep excavations and onsite waste disposal. The capability subclass is 11e; woodland ordination symbol is 4o.

#### **BrA—Brinkerton silt loam, 0 to 3 percent slopes.**

This nearly level, deep, poorly drained soil is on concave foot slopes, low broad upland areas, concave upland drainageways, and low areas bordering flood plains. Slopes range from 100 to 250 feet in length. Areas are irregular in shape and range from about 3 to 90 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil extends to a depth of 48 inches. It is mottled grayish brown and light brownish gray silty clay loam to a depth of 26 inches. A firm and brittle fragipan is at a depth of 26 inches. It is mottled, light brownish gray silty clay loam to a depth of 48 inches. The substratum, to a depth of 62 inches, is very firm, gray silty clay loam and is part of the fragipan.

Included in mapping are small areas of Comly and Holly soils, and areas that have a thicker surface layer than typical for the Brinkerton series.

This poorly drained soil has slow permeability and moderate available water capacity. Surface runoff is slow. This soil has a high water table within 6 inches of the surface part of the year. Rooting depth is restricted by the fragipan and the high water table. In unlimed areas, reaction is very strongly acid to medium acid in the surface layer and subsoil.

Most areas of this soil are used for pasture. When properly drained, it may occasionally be used for row crops. The potential is good for trees. This soil has serious limitations for many nonfarm uses because of the high water table and slow permeability.

When cultivated crops are grown, excess water must be removed. Diversions are needed to intercept runoff from higher nearby slopes, and covered or open drains

are needed to remove excess water and prepare the soil for timely tillage. Incorporating crop residues and manure into the surface layer will help maintain organic matter content.

This soil is suited for pasture. Overgrazing or grazing when this soil is wet are major concerns of pasture management. If the pasture is grazed when wet, the surface soil will become compacted. Proper stocking rates to maintain key plant species, rotation of pastures, and restricted grazing during wet periods are good management practices. Optimum production requires maintenance of fertility through periodic applications of nutrients.

Except in a few areas, this soil has been cleared of trees. This soil is suited to moisture-tolerant trees. Potential productivity is high, but the rooting depth is restricted by the dense lower subsoil and the high water table. Use of equipment is restricted for long periods by the high water table. Machine planting is practical on large areas.

This soil has limitations for most nonfarm uses. Slow permeability and the high water table are serious limitations for onsite disposal of waste. The capability subclass is 1Vw; woodland ordination symbol is 2w.

#### **BrB—Brinkerton silt loam, 3 to 8 percent slopes.**

This gently sloping, deep, poorly drained soil is on foot slopes, on low broad upland areas, in concave drainageways, and along stream heads. Slopes range from 100 to 300 feet in length. The areas vary in shape and range from about 2 to 43 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil extends to a depth of 48 inches. It is mottled grayish brown and light brownish gray silty clay loam to a depth of 26 inches. A firm and brittle fragipan is at a depth of 26 inches. It is mottled light brownish gray silty clay loam to a depth of 48 inches. The substratum, to a depth of 62 inches, is very firm, gray silty clay loam and is part of the fragipan.

Included in mapping are small areas of Comly, Readington, and Abbottstown soils.

This soil has slow permeability and moderate available water capacity. Surface runoff is slow. The high water table is within 6 inches of the surface part of the year. Rooting depth is restricted by the fragipan and high water table. In unlimed areas, reaction is very strongly acid to medium acid in the surface layer and subsoil.

Most areas are used for pasture. When properly drained, this soil may occasionally be used for row crops. The potential is good for trees. This soil has limitations for many nonfarm uses because of the high water table and slow permeability.

When cultivated, there is a moderate erosion hazard. Runoff can be reduced and erosion controlled by minimum tillage, use of cover crops, stripcropping, and including grasses and legumes in the crop rotation. Diversions, open drains, and covered drains are needed to remove excess surface runoff and allow for timely tillage.

Incorporating crop residues and manure into the surface layer will help maintain organic matter content.

This soil is suited for pasture. Overgrazing and grazing when the soil is wet are major concerns of management. If the pasture is grazed when wet, the surface soil will become compacted. Proper stocking rates to maintain key plant species, rotation of pastures, and restricted grazing during wet periods are recommended management practices. Optimum production requires maintenance of fertility through periodic applications of nutrients.

Except in a few areas, this soil has been cleared of trees. This soil is suited to moisture-tolerant trees. Potential productivity is high, but the rooting depth is restricted by the fragipan and high water table. Use of equipment is restricted during wet periods. Machine planting is practical on large areas.

This soil has limitations for most nonfarm uses because of slow permeability and the high water table. These limitations are serious for onsite disposal of waste. The capability subclass is IVw; woodland ordination symbol is 2w.

**BwB—Buchanan gravelly loam, 3 to 8 percent slopes.** This gently sloping, deep, moderately well drained and somewhat poorly drained soil is on colluvial foot slopes of mountains. Slopes are generally 300 to 1,000 feet in length. The areas are irregular in shape and about 5 to 142 acres in size.

Typically, the surface layer is dark brown gravelly loam about 8 inches thick. The subsoil is firm, mottled yellowish brown loam to a depth of 23 inches. A firm and brittle fragipan is at a depth of 23 inches. It is mottled, strong brown and yellowish red loam and extends to a depth of 60 inches.

Included with this soil in mapping are a few areas of Laidig and Brinkerton soils. Also included are scattered areas of slightly steeper Buchanan soils.

This moderately well drained and somewhat poorly drained soil is slowly permeable, and the available water capacity is low. Surface runoff is medium. This soil has a seasonal high water table within 6 to 24 inches of the surface for long periods during wet seasons. Rooting depth is restricted by the fragipan. In unlimed areas, reaction is extremely acid to strongly acid throughout.

Most areas of this soil are cultivated. A few areas are used for hay or pasture or for trees. Other areas are used for homesites. This soil is best suited to grass and pasture but can be used for crops under proper management. The potential is good for trees. The seasonal high water table and slow permeability limit the potential for many nonfarm uses.

When this soil is cultivated, there is a moderate hazard of erosion. Contour stripcropping, minimum tillage, sod, waterways, use of cover crops, and including grasses and legumes in the cropping system help to reduce runoff and control erosion. Diversions and covered

drains are needed to help remove excess water and allow for timely tillage. Incorporating crop residues and manure into the surface layer will help maintain organic matter content.

The potential is good for pasture. Overgrazing and grazing when this soil is wet are major concerns of management. If the pasture is grazed when wet, the surface soil will become compacted. Proper stocking rates to maintain key plant species, rotation of pastures, deferment of grazing, and restricted grazing during wet periods are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of lime and fertilizers.

This soil is suited to trees. Potential productivity is moderately high. A small acreage is wooded, and many idle areas are reverting to trees. Removal of undesirable species will help increase production. Logging roads should be planned on the contour to reduce erosion. Use of equipment is limited during wet seasons because of the seasonal high water table. Machine planting is practical on the larger areas.

This soil has limitations for most nonfarm uses because it is slowly permeable and has a seasonal high water table. Slow permeability and the seasonal high water table are serious limitations for onsite disposal of waste. The seasonal high water table is a potential hazard for buildings with basements. Foundation drains with proper outlets are needed to prevent seepage of water into basements. The capability subclass is IIe; woodland ordination symbol is 3o.

**BxB—Buchanan extremely stony loam, 3 to 8 percent slopes.** This gently sloping, deep, moderately well drained and somewhat poorly drained soil is on colluvial foot slopes at the base of mountains. Slopes are generally 300 to 1,000 feet in length. The areas are irregular in shape and about 10 to 89 acres in size. Stones cover about 15 to 50 percent of the surface.

Typically, the surface layer is very dark gray gravelly loam about 3 inches thick. The subsoil extends to a depth of about 60 inches. To a depth of 23 inches, it is light yellowish brown and yellowish brown friable and firm gravelly loam and loam with mottles in the lower part. Below that is a fragipan of mottled, strong brown and yellowish red loam and gravelly clay loam to a depth of 60 inches.

Included with this soil in mapping are a few areas of Laidig soils and a few areas of spring seeps. Also included are scattered areas of steeper Buchanan soils.

This soil is slowly permeable, and the available water capacity is low. Surface runoff is medium. This soil has a water table within 6 to 24 inches of the surface for long periods during wet seasons. Rooting depth is restricted by the fragipan. In unlimed areas, reaction is extremely acid to strongly acid throughout the soil.

Most areas of this soil are wooded and are state owned. A small acreage in the Blue and Second Moun-



tains is used for military training. This soil is best suited for trees. The seasonal high water table, slowly permeable subsoil, and surface stones limit its potential for many nonfarm uses.

This soil is too stony for cultivated crops and pasture. The stones are too large and numerous to be economically removed.

The potential is moderately high for trees. Removal of undesirable tree species will improve production. Proper construction of logging roads is a good practice.

This soil has limitations for most nonfarm uses because of the slow permeability, seasonal high water table, and the surface stones. These limitations are serious for onsite disposal of waste. The seasonal high water table is a potential hazard for buildings with basements. Foundation drains with proper outlets are needed to prevent seepage of water into basements. The capability subclass is VII; woodland ordination symbol is 3x.

**BxC—Buchanan extremely stony loam, 8 to 25 percent slopes.** This sloping and moderately steep, moderately well drained and somewhat poorly drained soil is on colluvial midslopes of mountains. Slopes are generally 300 to 1,000 feet in length and undulating. The areas are irregular in shape and about 6 to 300 acres in size. Large stones cover about 15 to 50 percent of the surface.

Typically, the surface layer is very dark gravelly loam about 3 inches thick. The subsoil extends to a depth of about 60 inches. To a depth of 23 inches it is light yellowish brown and yellowish brown friable and firm gravelly loam and loam with mottles in the lower part. Below that is a fragipan of mottled, strong brown loam and yellowish red loam and gravelly clay loam to a depth of 60 inches.

Included with this soil in mapping are a few areas of Laidig soils, Hazleton soils, and spring seeps. Also included are scattered areas of gently sloping Buchanan soils.

This soil is slowly permeable, and the available water capacity is low. Surface runoff is medium to rapid. The water table is within 6 to 24 inches of the surface for long periods during wet seasons. Plant rooting depth is restricted by the fragipan. In unlimed areas, reaction is extremely acid to strongly acid throughout.

Most areas of this soil are wooded and state owned. A small acreage in the Blue and Second Mountains is used for military training. This soil is best suited to trees. The seasonal high water table, slowly permeable subsoil, surface stones, and slope limit its potential for many nonfarm uses.

This soil is too stony for cultivated crops and pasture. The stones are too large and numerous to be economically removed.

The potential is moderately high for trees. Removal of undesirable tree species will help improve production. Proper construction of logging roads is a good practice.

This soil has limitations for most nonfarm uses because of the slow permeability, seasonal high water table, slope, and surface stones. These limitations are serious for onsite disposal of waste. The seasonal high water table is a potential hazard for buildings with basements. Foundation drains with proper outlets are needed to prevent seepage into basements. The capability subclass is VII; woodland ordination symbol is 3r.

**ByB—Bucks silt loam, 3 to 8 percent slopes.** This gently sloping, deep, well drained soil is on convex dissected uplands. Slopes are generally 300 to 700 feet in length and uniform. The areas are irregular in shape and are mainly 10 to 40 acres in size.

In a typical wooded area, the surface layer is dark reddish brown silt loam about 5 inches thick. The subsoil extends to a depth of 40 inches. It is weak red, friable silt loam to a depth of 20 inches. Below that is weak red, friable and firm silty clay loam. The substratum, to a depth of 60 inches, is weak red very channery silty clay loam.

Included with this soil in mapping are a few small areas of Penn soils, Ungers soils, and Abbottstown soils. Small spring seep areas are also included.

This soil has moderate permeability and high available water capacity. Surface runoff is medium. In unlimed areas, reaction is strongly acid to very strongly acid.

Most areas are cultivated. Small areas are used for trees and houses. The potential is very good for cultivated crops; this soil is well suited to pasture and trees. The potential for homesites is good. This soil has few limitations for most other nonfarm uses.

When this soil is cultivated, there is a moderate hazard of erosion. Crops respond well to fertilizer and good management. Stripcropping, minimum tillage, diversions, and sod waterways help control erosion. Growing cover crops, utilizing crop residue, and including hay in the cropping system are ways of maintaining the organic matter content and good tilth.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pasture are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, and potential productivity is moderately high. Management problems are slight. Machine planting is practical on the large areas. The capability subclass is IIe; woodland ordination symbol is 3o.

**CeB—Chester channery loam, 3 to 8 percent slopes.** This gently sloping, deep, well drained soil is on foot slopes of mountains and on broad upland valleys. Slopes are about 200 to 600 feet in length. The areas are broad, nearly oval to long, and irregular in shape and 5 to 120 acres in size.

Typically, the surface layer is dark brown channery loam about 8 inches thick. The subsoil extends to a

depth of 44 inches. It is yellowish red and strong brown channery heavy loam and channery silty clay loam to a depth of 29 inches. Below that is strong brown channery loam. The substratum is strong brown very channery loam to a depth of 60 inches.

Included in mapping are small areas of nearly level Chester soils, Chester soils that have a gravelly surface, small wet areas, and Brinkerton soils.

This well drained soil has moderate permeability. The available water capacity is low to moderate. Surface runoff is slow to medium. In unlimed areas, reaction is strongly acid to very strongly acid throughout.

This soil is used mainly for cultivated crops. A few areas are used for hay and pasture. Other areas are used for woods or homesites. This soil is well suited to cultivated crops, hay and pasture, and woodland production. It has few limitations for most nonfarm uses.

When the soil is cultivated, there is a moderate erosion hazard. Excess runoff can be reduced and controlled by minimum tillage, use of cover crops, stripcropping, diversions, and including grasses and legumes in the crop rotation. Incorporating crop residues and manure into the surface layer will help maintain organic matter content.

This soil is suited to pasture. Proper stocking rates and rotation of pastures can help prevent overgrazing and maintain key plant species. Optimum production requires maintenance of fertility through periodic applications of nutrients.

The potential is high for trees, but only a few areas are wooded. Management problems are slight, and machine planting is practical on large areas.

This soil has few limitations for most nonfarm uses. Management may be needed during construction to control erosion and sediment. The capability subclass is IIe; woodland ordination symbol is 2o.

**CeC—Chester channery loam, 8 to 15 percent slopes.** This sloping, deep, well drained soil is on convex foot slopes of mountains. Slopes are about 200 to 500 feet in length. Intermittent streams dissect the areas. These areas are broad to narrow and irregular in shape and about 10 to 85 acres in size.

Typically, the surface layer is dark brown channery loam about 8 inches thick. The subsoil extends to a depth of 44 inches. It is yellowish red to strong brown channery heavy loam and channery silty clay loam to a depth of 29 inches. Below that is strong brown channery loam. The substratum is strong brown very channery loam to a depth of 60 inches.

Included in mapping are small areas of gently sloping Chester soils and moderately steep Chester soils that are severely eroded. Small wet areas are also included.

This well drained soil has moderate permeability, and the available water capacity is low to moderate. Surface runoff is medium to rapid. In unlimed areas, reaction is strongly acid to very strongly acid throughout.

This soil is used mainly for cultivated crops. A few areas are used for hay and pasture. Other areas are used for woodland or homesites. This soil is well suited to cultivated crops, pasture, and woodland. It has some limitations for nonfarm uses because of slope.

When the soil is cultivated, there is a severe erosion hazard. Erosion can be controlled and runoff reduced by minimum tillage, use of cover crops, stripcropping, constructing diversions, and including grasses and legumes in the cropping system. Incorporating crop residues and manure into the surface layer will help maintain organic matter content.

This soil is suited to pasture. Proper stocking rates and rotation of pastures can help prevent overgrazing and maintain key plant species. Optimum production requires maintenance of fertility through periodic applications of nutrients.

The potential is high for trees. Except in a few areas, however, this soil has been cleared. Logging roads should be constructed on the contour to reduce erosion. Machine planting is practical on large areas.

Slope is a limitation for most nonfarm uses. Management is needed during construction to control erosion and sediment. The capability subclass is IIIe; woodland ordination symbol is 2o.

**ChC—Chester extremely stony loam, 8 to 25 percent slopes.** This sloping and moderately steep, deep, well drained soil is on upper side slopes and ridgetops of mountains. Slopes are 200 to 1,200 feet in length. The areas are crescent to irregular in shape. They are 5 to more than 700 acres in size. Many are dissected by streams. Large stones cover about 15 to 50 percent of the surface.

Typically, the surface layer is dark yellowish brown channery loam about 5 inches thick.

The subsurface layer is dark yellowish brown channery loam about 5 inches thick. The subsoil extends to a depth of 44 inches. It is yellowish red and strong brown channery heavy loam and channery silty clay loam to a depth of 31 inches. Below that is strong brown channery loam to a depth of 44 inches. The substratum is strong brown very channery loam.

Included in mapping are small areas of Holly soils, Rock outcrop, and Rubble land. Also included are nearly level to gently sloping areas of Chester extremely stony loam and areas of similar soils that have a thin sandy loam surface layer.

This well drained soil has moderate permeability, and the available water capacity is low to moderate. Surface runoff is medium to rapid. Reaction is strongly acid to very strongly acid throughout.

This soil is used mostly for woodland. A few areas are used for homesites. This soil can be used for wildlife habitat and recreation.



Figure 3.—Clarksburg silt loam, 0 to 3 percent slopes, in depression receives runoff from the Hagerstown soils in the foreground and background and is sometimes ponded for short periods.

This soil is too stony for cultivated crops or pasture. The surface stones are too large and numerous to be economically removed.

The potential is high for trees. Removing undesirable tree species will improve production. Construction of logging roads on the contour will reduce erosion. Large stones interfere with equipment and machine planting.

This soil has severe limitations for nonfarm uses because of the surface stones and slope. It has some potential for wildlife and recreation uses. The capability subclass is VII<sub>s</sub>; woodland ordination symbol is 2x.

**CkA—Clarksburg silt loam, 0 to 3 percent slopes.**

This nearly level, moderately well drained soil is on concave areas on the uplands in the limestone valley. It formed in material weathered from limestone on broad, lower slopes, in drainageways, and in depressions. Slopes are generally 150 to 1,000 feet in length. The areas are wide and irregular in shape and from about 2 to 200 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil extends to a depth of 62 inches. It is light yellowish brown and yellowish brown friable silt loam and silty clay loam to a depth of 22 inches. Below that is a fragipan of yellowish brown, firm and brittle, heavy silt loam and silty clay loam to a depth

of 38 inches. Below the fragipan is mottled, brownish yellow and strong brown, friable light silt loam. The substratum is mottled, variegated, strong brown, brownish yellow, and yellow, friable to firm light silt loam and loam to a depth of 81 inches.

Included with this soil in mapping are a few areas of Hagerstown, Thorndale, and Nolin Variant soils and a few areas of gently sloping Clarksburg soils. Also included are scattered areas of Clarksburg soils that have a gravelly surface layer.

This soil has slow permeability, and the available water capacity is moderate. Surface runoff is slow. The water table is within 18 to 36 inches of the surface for long periods during wet seasons. Ponding for short periods occurs in enclosed depressions and in drainageways. Rooting depth is restricted by the fragipan. In unlimited areas, reaction is strongly acid to slightly acid throughout.

Most areas are cultivated. Other areas are in the urbanized section of the limestone valley. A few areas are woodland. This soil can be used for crops, under proper management. The potential is good for trees. The seasonal high water table and slowly permeable subsoil limit potential for many nonfarm uses.

When this soil is cultivated, drainage may be needed to remove excess water (fig. 3). Minimum tillage, sod

waterways, use of cover crops, and including grasses and legumes in the cropping system help reduce runoff and control erosion. Diversions and covered drains are needed to help remove excess water and permit timely tillage. Incorporating crop residues and manure into the surface layer will help maintain organic matter content.

The potential is very good for pasture. Overgrazing and grazing when this soil is wet are major concerns of management. If the pasture is grazed when wet, the surface soil will become compacted. Proper stocking rates to maintain key plant species, rotation of pastures, deferment of grazing, and restricted grazing during wet periods are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

The potential is moderately high for trees. A small acreage is wooded, and many idle areas are reverting to trees. Removal of undesirable species will help increase production. Logging roads should be constructed on the contour to reduce erosion. Use of equipment is limited during wet seasons by seasonal high water table. Machine planting is practical on the larger areas.

This soil has limitations for many nonfarm uses because it is slowly permeable and has a seasonal high water table. Slow permeability and the seasonal high water table are serious limitations for onsite disposal of waste. The seasonal high water table is a potential hazard for buildings with basements. When buildings with basements are constructed on this soil, foundation drains with proper outlets should be installed to prevent seepage of water into the basements. The capability subclass is 1lw; woodland ordination symbol is 3w.

**CkB—Clarksburg silt loam, 3 to 8 percent slopes.**

This gently sloping, moderately well drained soil is on concave areas on the uplands in the limestone valley. It formed in material weathered from limestone on broad lower slopes, in drainageways, and in depressions. Slopes are generally 150 to 1,200 feet in length and uniform. The areas are wide and irregular in shape and from about 2 to 200 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil extends to a depth of about 62 inches. It is light yellowish brown and yellowish brown friable silt loam and silty clay loam to a depth of 22 inches. Below that is a fragipan of yellowish brown, firm and brittle, heavy silt loam and silty clay loam to a depth of 38 inches. The lower subsoil is mottled, brownish yellow and strong brown, friable light silt loam. The substratum is mottled, variegated, strong brown, brownish yellow, and yellow, friable to firm light silt loam and loam.

Included with this soil in mapping are a few areas of Hagerstown, Duffield, Thorndale, and Nolin Variant soils and a few areas of nearly level Clarksburg soils. Also included are scattered areas of Duffield soils that have a gravelly surface.

This soil has slow permeability, and the available water capacity is moderate. Surface runoff is medium. The water table is within 18 to 36 inches of the surface for long periods during wet seasons. Ponding occurs for short periods in enclosed depressions and in drainageways. Rooting depth is restricted by the fragipan. In unlimed areas, reaction is strongly acid to slightly acid throughout.

Most areas are cultivated. Other areas are in the urbanized section of the limestone valley. A few areas are woodland. This soil is suited to crops and pasture, under proper management. The potential is very good for trees. The seasonal high water table and slowly permeable subsoil limit potential for many nonfarm uses.

When this soil is cultivated, there is a moderate hazard of erosion. Contour stripcropping, minimum tillage, sod waterways, use of cover crops, and including grasses and legumes in the cropping system help reduce runoff and control erosion. Diversions and covered drains are needed to remove excess water and permit timely tillage. Incorporating crop residues and manure into the surface layer will help maintain organic matter content.

The potential is very good for pasture. Overgrazing and grazing when this soil is wet are major concerns of management. If the pasture is grazed when wet, the surface soil will become compacted. Proper stocking rates to maintain key plant species, rotation of pastures, deferment of grazing, and restricted grazing during wet periods are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

The potential is moderately high for trees. A small acreage is wooded, and many idle areas are reverting to trees. Removal of undesirable species will help increase production. Logging roads should be constructed on the contour to reduce erosion. Use of equipment is limited during wet seasons by the seasonal high water table. Machine planting is practical on the larger areas.

This soil has limitations for many nonfarm uses because it is slowly permeable and has a seasonal high water table. Slow permeability and the seasonal high water table are serious limitations for onsite disposal of waste. The seasonal high water table is a potential hazard for buildings with basements. When buildings with basements are constructed on this soil, foundation drains with proper outlets should be installed to prevent seepage of water into basements. The capability subclass is 1le; woodland ordination symbol is 3w.

**CmA—Comly silt loam, 0 to 3 percent slopes.**

This nearly level, deep, moderately well drained and somewhat poorly drained soil is in narrow drainageways between steeper soils that have more convex slopes, in broad fanlike areas below spring seeps, in depressional areas, on broad upland flats. Slopes are 300 to 500 feet in length. The areas are long and narrow to very broad in shape and about 5 to 50 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil extends to a depth of 61 inches. To a depth of 32 inches it is yellowish brown, friable and firm, shaly silt loam, with mottles in the lower 12 inches. Below that is a fragipan of mottled, yellowish brown silt loam and shaly silt loam to a depth of 61 inches.

Included in mapping are small areas of Brinkerton soils and gently sloping Comly soils.

This soil has moderate permeability in the surface layer and upper part of the subsoil and moderately slow permeability in the lower part of the subsoil. Available water capacity is moderate. Surface runoff is slow. Rooting depth is restricted by the fragipan in the lower part of the subsoil. In unlimed areas, reaction is very strongly acid or strongly acid in the upper part of the solum and medium acid or strongly acid in the lower part.

This soil is used mainly for cultivated crops. A few areas are used for hay or pasture, other areas are used for homesites. This soil is suited to cultivated crops, hay and pasture, and woodland. It has limitations for nonfarm uses because of the seasonal high water table and moderately slow permeability. When this soil is cultivated, there is a slight erosion hazard. Open and closed drains are needed to remove excess water and prepare the soil for timely tillage. Diversions to intercept excess runoff from higher areas may be needed in some areas. Incorporating crop residues and manure into the surface layer will help maintain organic matter content.

This soil is suited to pasture. Overgrazing and grazing when this soil is wet are major concerns of management. If the pasture is grazed when wet, the surface soil will become compacted. Proper stocking rates to maintain key plant species and rotation of pastures are good management practices. Optimum production requires maintenance of fertility through periodic applications of nutrients.

The potential is moderately high for trees. Except in a very few areas, however, this soil has been cleared. Woodland management problems are slight.

This soil has limitations for many nonfarm uses because of moderately slow permeability and the seasonal high water table. The limitation for onsite waste disposal is serious. Buildings with basements should have foundation drains with proper outlets to prevent seepage of water into the basements. Management during construction needs to control erosion and sediment. The capability subclass is 1lw; woodland ordination symbol is 3o.

**CmB—Comly silt loam, 3 to 8 percent slopes.** This gently sloping, deep, moderately well drained and somewhat poorly drained soil is on broad upland flats, in drainageways, and within areas having spring seeps. Slopes are 300 to 600 feet in length. The areas are long and narrow to very broad in shape and about 5 to 40 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil extends to a depth of 61 inches. To a depth of 32 inches, it is yellowish brown, friable and firm, shaly silt loam with mottles in the lower 12 inches. Below that, to a depth of 61 inches, is a fragipan of silt loam and shaly silt loam that is firm and very firm and brittle.

Included in mapping are small areas of Brinkerton soils and Comly soils that have nearly level slope.

This soil has moderate permeability in the surface layer and upper part of the subsoil and moderately slow permeability in the lower part of the subsoil. Available water capacity is moderate. Surface runoff is medium. Rooting depth is restricted by the fragipan. In unlimed areas, reaction is very strongly acid or strongly acid in the upper part of the solum and medium acid or strongly acid in the lower part.

This soil is used mainly for cultivated crops. A few areas are used for hay or pasture. Other areas are used for homesites. This soil is suited to cultivated crops, hay and pasture, and woodland. It has limitations for many nonfarm uses because of the seasonal high water table and moderately slow permeability.

When cultivated there is a moderate erosion hazard. Runoff can be reduced and erosion controlled by minimum tillage, use of cover crops, stripcropping, and including grasses and legumes in the cropping rotation. Diversions and covered drains are needed to remove excess water and allow for timely tillage. Incorporating crop residues and manure into the surface layer will help maintain organic matter content.

This soil is suited to pasture. Overgrazing or grazing when the soil is wet are major concerns of management. If the pasture is grazed when wet, the surface soil will become compacted. Proper stocking rates to maintain key plant species and rotation of pastures will prevent overgrazing and help maintain key plant species. Optimum production requires maintenance of fertility through periodic applications of nutrients.

The potential is moderately high for trees. Except for a very few areas, however, this soil has been cleared. Woodland management problems are slight, and machine planting is practical on larger areas.

This soil has limitations for many nonfarm uses because of moderately slow permeability in the lower part of the subsoil and the seasonal high water table. Onsite waste disposal limitation is serious. Buildings with basements should have foundation drains with proper outlets to prevent wet basements. Management may need to control erosion and sediment during construction. The capability subclass is 1le; woodland ordination symbol is 3o.

**DfA—Duffield silt loam, 0 to 3 percent slopes.** This nearly level, deep, well drained soil is on uplands in the limestone valley (fig. 4). These soils formed in material weathered from limestone. They are between higher po-

sitions in the landscape and in flat areas. Slopes are generally 300 to 11,000 feet in length. The areas are irregular in shape and about 10 to 100 acres in size.

When this soil is cultivated, there is a slight hazard of erosion. Crops respond well to fertilizer and good management. Growing cover crops, utilizing crop residue,



Figure 4.—Typical area of Duffield silt loam, 0 to 3 percent slopes, in the limestone valley.

Typically, the surface layer is dark brown silt loam about 11 inches thick. The subsoil extends to a depth of 61 inches. It is yellowish brown light silt loam to a depth of 14 inches. Below that is yellowish brown, firm and friable silty clay loam and loam. The substratum is light olive brown, friable loam to a depth of 70 inches.

Included with this soil in mapping are a few areas of Hagerstown, Clarksburg, and Nolin Variant soils and Duffield soils that have a gravelly surface layer. Duffield soils in depressions that have a thicker surface layer and gently sloping Duffield soils are also included.

This soil has moderate permeability and high available water capacity. Surface runoff is slow. In unlimed areas, reaction is strongly acid to neutral to a depth of 50 inches and strongly acid to slightly acid below that.

Most areas of this soil are cultivated. Small areas are used for trees and houses. The potential is excellent for cultivated crops. This soil is well suited to pasture and trees. The potential for homesites is good, but areas where the depth to bedrock is 4 to 6 feet or where solution channels develop may present problems for onsite waste disposal. The potential is good for many other nonfarm uses.

and including hay in the cropping system are ways of maintaining organic matter content and good tilth.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pasture are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a very small acreage is wooded. Potential productivity is very high. Management problems are slight. Machine planting is practical on large areas.

This soil has limitations for nonfarm uses in areas where the depth to bedrock is minimal and sinkholes are common. The minimum depth to bedrock and solution channels are limitations and serious hazards for onsite waste disposal. The capability class is I; woodland ordination symbol is 10.

**DfB—Duffield silt loam, 3 to 8 percent slopes.** This gently sloping, deep, well drained soil is on undulating uplands in the limestone valley. These soils formed in material weathered from limestone. Slopes are long and smooth. The areas are irregular in shape and are about 4 to 1,130 acres in size.



Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil extends to a depth of 60 inches. It is yellowish brown, friable light silt loam to a depth of 13 inches. Below that is yellowish brown firm to friable silty clay loam to loam. The substratum is light olive brown friable loam.

Included with this soil in mapping are a few small areas of Hagerstown, Clarksburg, and Nolin Variant soils. Small, scattered areas of Duffield soils that have a gravelly surface layer and nearly level Duffield soils are also included.

This soil has moderate permeability and high available water capacity. Surface runoff is medium. In unlimed areas, reaction is strongly acid to neutral to a depth of 50 inches and strongly acid to slightly acid below that.

Most areas of this soil are cultivated. Small areas are used for trees and houses. The potential is very good for farming; this soil is well suited to pasture and trees. The potential for homesites is good, but the areas where the depth to bedrock is 4 to 6 feet or where solution channels develop may present problems for onsite waste disposal. The potential is good for many other nonfarm uses.

When this soil is cultivated, there is a moderate hazard of erosion. Crops respond well to fertilizers and good management. Stripcropping, minimum tillage, diversions, and sod waterways help control erosion. Growing cover crops, utilizing crop residue, and including hay in the cropping system are ways of maintaining organic matter content and good tilth.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pasture are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a very small acreage is wooded. Potential productivity is very high. Management problems are slight. Machine planting is practical on large areas.

This soil has some limitations for nonfarm uses in those areas where the depth to bedrock is minimal or where solution channels develop. The minimum depth to bedrock and solution channels are also limitations for onsite waste disposal. The capability subclass is IIe; woodland ordination symbol is 1o.

#### **DfC—Duffield silt loam, 8 to 15 percent slopes.**

This sloping, deep, well drained soil is on undulating uplands. Slopes are generally 100 to 350 feet in length. The areas are narrow and elongated in shape and about 4 to 40 acres in size.

Typically, the surface layer is strong brown silt loam about 9 inches thick. The subsoil extends to a depth of 6 inches. It is yellowish brown, light silt loam to a depth of 12 inches. Below that is yellowish brown, firm and friable silty clay loam and loam. The substratum is light olive brown, friable loam.

Included with this soil in mapping are a few areas of sloping Hagerstown soils and scattered areas of gently sloping Hagerstown and Duffield soils and Rock outcrop.

This soil has moderate permeability and high available water capacity. Surface runoff is medium to rapid. In unlimed areas, reaction is strongly acid to neutral to a depth of 50 inches and strongly acid to slightly acid below that.

Most acreages of this soil are cultivated. Small areas are used for trees and houses. The potential is excellent for cultivated crops; this soil is very well suited to pasture and trees. The potential for homesites is fair, but in areas where the depth to bedrock is 4 to 6 feet, or where solution channels have developed, there may be problems for onsite waste disposal. There is potential for many other nonfarm uses.

When this soil is cultivated, there is a severe hazard of erosion. Crops respond well to fertilizers and good management. Growing cover crops, utilizing crop residue, and including hay in the cropping system are ways for maintaining organic matter content and good tilth. Contour stripcropping, minimum tillage, sod waterways, and diversion terraces can be used to control erosion.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pastures are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a small acreage is wooded. Potential productivity is very high. Management problems are slight. Machine planting is practical on large areas.

This soil has some limitations for nonfarm uses in areas where depth to bedrock is minimal or where solution channels have developed. The minimum depth to bedrock and solution channels are also limitations and serious hazards for onsite waste disposal. The capability subclass is IIle; woodland ordination symbol is 1o.

**Dp—Dumps.** These are miscellaneous areas excavated for burial of refuse and wastes from residential and industrial sites. Pits are opened, and then refuse is placed into them and layered with soil material excavated from the site. This is done until the pits are filled. Slopes range from 0 to 35 percent. The areas are long and narrow in shape and from 5 to more than 10 acres in size. Included in mapping are some small areas of soils that have not been disturbed.

Dumps are too variable to estimate for most uses, and onsite investigation is needed to determine specific problems. Capability subclass and woodland ordination symbol are not assigned.

#### **HaA—Hagerstown silt loam, 0 to 3 percent slopes.**

This nearly level, deep, well drained soil is on the higher hills in the landscape and on valley floors of the uplands. Slopes are generally 150 to 1,200 feet in length and

smooth. The areas are irregular in shape and about 4 to 20 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches or more. It is strong brown, friable silty clay loam to a depth of 13 inches. Below that is yellowish red and strong brown, friable silty clay and silty clay loam.

Included with this soil in mapping are a few areas of Duffield soils, Clarksburg soils, Nolin Variant soils, and scattered Hagerstown soils that have a gravelly or thicker surface layer, and gently sloping Hagerstown and Duffield soils. Rock outcrops are also included.

This soil has moderate permeability and high available water capacity. Surface runoff is slow. In unlimed areas, the soil is very strongly acid or strongly acid in the upper part of the subsoil and strongly acid to neutral in the lower part of the subsoil.

Most areas of this soil are cultivated. Small areas are used for trees and houses. The potential is excellent for cultivated crops; this soil is well suited to pasture and trees. The potential for homesites is good. In places, bedrock at a depth of 3 1/2 to 6 feet or solution channels in the bedrock may present problems for onsite

waste disposal. Sinkholes and solution channels (fig. 5) are limitations for most other nonfarm uses.



Figure 5.—Sinkholes in Hagerstown silt loam, 0 to 3 percent slopes, present problems for most nonfarm uses. These are caused by eroded solution channels in underlying bedrock



Figure 6.—Hagerstown silt loam, 0 to 3 percent slopes, is dominantly used for corn. Crop residue is left to help maintain the organic matter content and good tilth.



When this soil is cultivated there is a slight hazard of erosion. Crops respond well to fertilizer and good management. Growing cover crops, utilizing crop residues (fig. 6), and including hay in the cropping system are ways of maintaining organic matter content and good tilth.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pastures are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is well suited to trees, but only a very small acreage is wooded. Potential productivity is very high. Management problems are slight. Machine planting is practical on the large areas.

This soil has some limitations for nonfarm uses because of the depth to bedrock in places or solution channels. The depth to bedrock in places and solution channels are limitations and hazards for onsite waste disposal. The capability class is I; woodland ordination symbol is 1c.

**HaB—Hagerstown silt loam, 3 to 8 percent slopes.**

This gently sloping, deep, well drained soil is on undulating uplands. Slopes are 300 to 1,100 feet in length and smooth. The areas are irregular in shape and about 3 to 100 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches or more. It is strong brown, friable silty clay loam to a depth of 13 inches. Below that is yellowish red and strong brown, friable silty clay and silty clay loam.

Included with this soil in mapping are a few small areas of Duffield soils, Clarksburg soils, and Nolin Variant soils. Scattered areas of Hagerstown soils that have a gravelly surface layer, severely eroded Hagerstown soils that have a silty clay loam surface layer, and nearly level Duffield soils are also included. Rock outcrop is included in many areas.

This soil has moderate permeability and a high available water capacity. Surface runoff is medium. In unlimed areas, the soil is very strongly acid or strongly acid in the surface layer and upper part of the subsoil and strongly acid to neutral in the lower part of the subsoil.

Most areas of this soil are cultivated. Small areas are used for trees and houses. The potential is excellent for cultivated crops, this soil is well suited to pasture and trees. The potential for homesites is good, but in places bedrock at a depth of 3 1/2 to 6 feet or solution channels in the bedrock may present problems for onsite waste disposal. This soil also has limitations for most other nonfarm uses where there are sinkholes and solution channels.

When this soil is cultivated, there is a moderate hazard of erosion. Crops respond well to fertilizer and good management. Stripcropping, minimum tillage, diversions, and sod waterways help control erosion. Growing cover crops, utilizing crop residue, and including hay in the cropping system are ways of maintaining organic matter content and good tilth.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pasture are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a very small acreage is wooded. Potential productivity is very high. Management problems are slight. Machine planting is practical on large areas.

This soil has some limitations for nonfarm uses because of depth to bedrock in places or solution channels. The depth to bedrock in places and solution channels are limitations and hazards for onsite waste disposal. The capability subclass is IIe; woodland ordination symbol is 1c.

**HbC—Hagerstown silty clay loam, 8 to 15 percent slopes.**

This sloping, deep, well drained soil is on undulating uplands. Slopes are generally 100 to 300 feet in length. The areas are narrow and elongated in shape and about 2 to 30 acres in size.

Typically, the surface layer is strong brown silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches or more. It is strong brown friable silty clay loam to a depth of 13 inches. Below that is yellowish red and strong brown, friable silty clay and silty clay loam.

Included with this soil in mapping are a few areas of Duffield soils and scattered areas of moderately steep Hagerstown soils and Rock outcrop.

This soil has moderate permeability and high available water capacity. Surface runoff is medium to rapid. In unlimed areas, the soil is very strongly acid or strongly acid in the surface layer and strongly acid to neutral in the lower part of the subsoil.

Most acreages of this soil are cultivated. Small areas are used for trees and houses. The potential is excellent for farming; this soil is very well suited to pasture and trees. The potential for homesites is fair, but bedrock at a depth of 3 1/2 to 6 feet in places and solution channels in the bedrock may present problems for onsite waste disposal. Slope is also a limitation for most other nonfarm uses.

When this soil is cultivated, there is a severe hazard of erosion. Crops respond well to fertilizer and good management. Growing cover crops, utilizing crop residue, and including grasses and legumes in the cropping system are ways of maintaining organic matter content and good tilth. Stripcropping, minimum tillage, diversions, and sod waterways control runoff and erosion.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pastures are chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

The soil is suited to trees, but only a small acreage is wooded. Potential productivity is very high. Management problems are slight. Machine planting is practical on the larger areas.

This soil has some limitations for nonfarm uses because of slope, depth to bedrock in places, sinkholes, and solution channels. The depth to bedrock and solution channels are also limitations and hazards for onsite waste disposal. The capability subclass is IIIe; woodland ordination symbol is 1c.

**HeB—Hagerstown-Rock outcrop complex, 3 to 8 percent slopes.** This gently sloping complex is on undulating uplands. Slopes are 50 to 200 feet in length. The areas are narrow and elongated in shape and are about 4 to 40 acres in size.

The Hagerstown soils make up about 65 percent of this complex. Typically this soil has a strong brown silt loam surface layer about 8 inches thick. The subsoil extends to a depth of 60 inches or more. It is strong brown friable silty clay loam to a depth of 13 inches. Below that is yellowish red and strong brown, friable silty clay loam to silty clay loam.

The Rock outcrop makes up about 20 percent of this complex. It consists of exposures of limestone bedrock.

This soil and Rock outcrop are mapped together because they occur in such intricate patterns that it was not practical to map them separately.

Included with this complex in mapping are small areas of Duffield soils and some soils similar to Hagerstown soils that are moderately deep and shallow.

The Hagerstown soils have moderate permeability and high available water capacity. In unlimed areas, they are very strongly acid or strongly acid in the surface layer and upper part of the subsoil and strongly acid to neutral in the lower part of the subsoil. Runoff is medium to rapid. Rooting depth may be restricted by bedrock.

The potential is poor for cultivated crops because of the amount of Rock outcrops; but because of its position on the landscape, this complex may be included in nearby cultivated areas. It is also used for woods and pasture. Other areas are urbanized, but the potential is **better for pasture and woodland**. Rock outcrop and bedrock at a depth of 3 1/2 to 6 feet in places are limitations for most nonfarm uses.

When this complex is used for pasture, proper stocking rates to maintain key plant species and rotation of pasture are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

A small acreage of this complex is in woodland. Potential productivity is very high on the Hagerstown soil and

low on Rock outcrops. Rooting depth may be restricted by the depth to bedrock.

This complex has limitations for nonfarm uses because of the Rock outcrop. Rock outcrop and restricted depth to bedrock in places are problems in excavating for buildings and are serious limitations and hazards for onsite waste disposal. If this complex is disturbed for construction, erosion may need to be controlled. The capability class is VIc. Woodland ordination symbol for the Hagerstown soil is 1c, but Rock outcrop is not rated.

**HeC—Hagerstown-Rock outcrop complex, 8 to 25 percent slopes.** This sloping and moderately steep complex is on undulating uplands. Slopes are 50 to 150 feet in length. The areas are narrow and elongated in shape and about 4 to 40 acres in size.

The Hagerstown soil makes up about 60 percent of this complex. Typically, this soil has a strong brown silt loam surface layer about 8 inches thick. The subsoil extends to a depth of 60 inches or more. It is strong brown silty clay loam to a depth of 13 inches. Below that is yellowish red and strong brown silty clay and silty clay loam.

Rock outcrop makes up about 30 percent of this complex. It consists of exposures of bare limestone bedrock.

This soil and Rock outcrop are mapped together because they occur in such intricate patterns that it was not practical to map them separately. Included with this complex in mapping are small areas of Duffield soils and moderately deep and shallow soils that are otherwise similar to Hagerstown soils.

The Hagerstown soil has moderate permeability and a high available water capacity. Where unlimed, the soil is very strongly acid or strongly acid in the surface layer and upper part of the subsoil and strongly acid to neutral in the lower part of the subsoil. Surface runoff is medium to rapid. The rooting depth may be restricted by the bedrock.

The potential is poor for cultivated crops, but, because of its position on the landscape, this complex is often included in nearby cultivated areas. It is also used for pasture and woodland. Rock outcrop, slope, and bedrock at a depth of 3 1/2 to 6 feet are limitations for most nonfarm uses.

When this complex is used for pasture, proper stocking rates to maintain key plant species and rotation of pastures are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

A small acreage of this complex is in woodland. Potential productivity is very high on the Hagerstown part but very low on the Rock outcrop part of the unit. Rooting depth may be restricted by the depth to bedrock. Erosion needs to be controlled during harvesting. Rock outcrop interferes with mechanical seeding and harvesting.

This complex has limitations for nonfarm uses because of depth to rock in places, slope, and Rock out-

crop. The depth to bedrock in places may present problems in excavating for buildings and is a serious limitation and hazard for onsite waste disposal. If this complex is disturbed for construction, special management may be needed to control erosion. Sinkholes and ground water contamination are also potential hazards. The capability subclass is VI<sub>s</sub>. Woodland ordination symbol for the Hagerstown part is 1c, but Rock outcrop part is not rated.

**HHB—Hazleton extremely stony sandy loam, gently sloping.** This gently sloping, deep, well drained soil is on lower side slopes of valleys and ridgetops of mountains. The composition of this map unit varies somewhat more than that of most other units in the county. Slopes are 200 to 1,200 feet in length. The areas are broad to narrow and irregular in shape and 10 to 400 acres in size. They are commonly parallel to the mountains. Large stones cover about 15 to 50 percent of the surface.

Typically, the surface layer is very dark grayish brown sandy loam about 3 inches thick. The subsurface layer is grayish brown sandy loam to a depth of 7 inches. The subsoil extends to a depth of 34 inches. It is dark brown channery loam to a depth of 14 inches and strong brown channery loam and very channery loam to a depth of 34 inches. The substratum is strong brown very channery loam to a depth of 63 inches.

Included in mapping are areas of deep soils that have a yellowish red or red subsoil, Laidig soils, Hazleton soils that have a loam surface layer, Calvin soils, Rock outcrop, Rubble land, Hazleton soils that have a less stony surface layer, and wet spots. These included areas range from 3 to 25 acres in size and make up about 15 to 25 percent of this map unit.

This soil has moderately rapid to rapid permeability and available water capacity is low. Surface runoff is medium. Reaction is strongly acid to extremely acid.

Most areas are used for woodland and wildlife habitat and are state owned. A small acreage in the Blue and Second Mountains is used for military training. The potential for urban use is poor because of surface stones.

This soil is too stony for cultivated crops and pasture. The stones are too large and numerous to be removed economically.

The potential is moderately high for trees. Removal of undesirable tree species will help improve production. Proper construction of logging roads is a good management practice.

This soil is severely limited for nonfarm uses by the numerous surface stones. The capability subclass is VII<sub>s</sub>; woodland ordination symbol is 3x.

**HHE—Hazleton extremely stony sandy loam, steep.** This steep and very steep, deep, well drained soil is on ridges of mountains. The composition of this map unit varies somewhat more than that of most other units

in the county. Slopes are 200 to 1,200 feet in length. The areas are broad to narrow and irregular in shape and 10 to 700 acres in size. They are commonly parallel to the mountains. Large stones cover about 15 to 50 percent of the surface.

Typically, the surface layer is very dark grayish brown sandy loam, about 3 inches thick. The subsurface layer is grayish brown sandy loam to a depth of 7 inches. The subsoil extends to a depth of 34 inches. It is brown channery loam to a depth of 14 inches and strong brown very channery loam below that. The substratum is strong brown very channery loam to a depth of 63 inches.

Included in mapping are areas of Laidig soils, deep soils that have a yellowish red or red subsoil, Calvin soils, Hazleton soils that have a loam surface layer, Rock outcrop, and Rubble land. These included areas range from 3 to 25 acres in size and make up about 15 to 25 percent of this unit.

This soil has moderately rapid to rapid permeability. Available water capacity is low. Surface runoff is rapid. Reaction is strongly acid to extremely acid.

The areas are used for woodland and wildlife habitat. Most are state owned. A small acreage in the Blue and Second Mountains is used for military training. The potential for urban use is poor because of slope and surface stones.

This soil is too stony and steep for cultivated crops and pasture. The potential is moderately high for trees. Removal of undesirable tree species will help improve production. Proper construction of logging roads helps prevent erosion during harvesting.

This soil has severe limitations for nonfarm uses because of slope and numerous surface stones. The capability subclass is VII<sub>s</sub>; woodland ordination symbol is 3x.

**HLD—Hazleton-Laidig association, moderately steep.** This association consists of extremely stony, sloping and moderately steep, deep, well drained soils on side slopes and near the ridgetops. The composition of this map unit varies somewhat more than that of most other units in the county. Hazleton soils are on the higher positions, and Laidig soils are on the lower parts of the side slopes. The areas are heavily wooded and mostly inaccessible. Because of the extreme stoniness and other limitations these soils were not mapped separately. Both soils are in each delineation. About 40 percent of the unit is Hazleton soils, about 30 percent is Laidig soils, and the balance is included soils and miscellaneous areas. Slopes are 500 to 1,200 feet in length. The areas are 10 acres to 400 acres in size. Large stones cover about 15 to 50 percent of the surface.

Typically, in a Hazleton soil, the surface layer is very dark grayish brown and grayish brown sandy loam about 7 inches thick. The subsoil extends to a depth of 34 inches. It is dark brown channery loam to a depth of 14 inches. Below that is strong brown channery and very

channery loam. The substratum is strong brown very channery loam to a depth of 63 inches.

Typically, in a Laidig soil, the surface layer is very dark grayish brown channery loam about 3 inches thick. The subsurface layer is grayish brown channery loam to a depth of 7 inches. The subsoil extends to a depth of 80 inches. It is yellowish brown and strong brown friable to firm channery heavy loam to a depth of 31 inches. Below that is a fragipan of firm and brittle, yellowish red, channery sandy clay loam.

Included in mapping are areas of deep soils that have a yellowish red and red subsoil, Calvin soils, Rock outcrop, Rubble land, strip-mined areas, very stony surfaces, gently sloping Hazleton or Laidig soils, and wet spots. These included areas range from 3 to 25 acres in size and make up about 15 to 25 percent of this unit.

Hazleton soils have moderately rapid to rapid permeability. Laidig soils have moderate to moderately rapid permeability in the surface layer and upper part of the subsoil and moderately slow permeability in the lower part of the subsoil. Available water capacity is low in Hazleton soils and moderate in Laidig soils. Surface runoff is medium on Hazleton soils and medium to rapid on Laidig soils. Hazleton soils are strongly acid to extremely acid, and Laidig soils are very strongly acid to extremely acid.

Areas of this association are used mostly for woodland and wildlife. Most areas are state owned. A small acreage in the Blue and Second Mountains is used for military training. The potential for urban use is poor because of surface stones and slopes.

This association is too stony for cultivated crops or pasture. The stones are too large and numerous to be economically removed.

The potential is moderately high for trees. Removal of undesirable tree species improves production. Proper construction of logging roads is a good management practice to reduce erosion during harvesting.

The soils have severe limitations for most nonfarm uses because of surface stones and slope. The capability subclass is VII<sub>s</sub>; woodland ordination symbol is 3x.

**Ho—Holly silt loam.** This nearly level, deep, very poorly drained and poorly drained soil is on flood plains of the larger, prominent creeks and narrow streams that dissect the upland areas and is formed in sediment washed from uplands. Slopes are 100 to 350 feet in length and are uniform. The areas are narrow to wide and irregular in shape and range from 20 to 75 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil extends to a depth of 40 inches. It is dark grayish brown, light brownish gray, and grayish brown silt loam to a depth of 26 inches and gray light silty clay loam below that. The subsoil is mottled throughout. The substratum is gray loamy sand to a depth of 60 inches.

Included with this soil in mapping are small areas of Philo and Brinkerton soils, coal wash sediment, stony areas, and gouged areas.

This soil has moderately slow and moderate permeability. Available water capacity is high. Holly soils are subject to frequent flooding. Streambank erosion and gouging occur during floods. Reaction when unlimed is neutral to strongly acid in the surface layer and upper part of the subsoil.

Most areas are used for pasture. Other areas are in trees. This soil is not well suited to agricultural uses because of frequent flooding. If adequately drained, this soil has limited use for cultivated crops. It is better suited to pasture or trees. It has serious limitations for many nonfarm uses because of a high water table and flooding.

Cultivated crops may be damaged by floodwaters following intensive rainfall. Excess surface water can be drained away by keeping natural drainageways open. Open drains with adequate outlets can improve drainage. Tillage should be done after floodwater and water ponded in depressions have receded enough to allow proper tillage without destruction of soil structure. Incorporating crop residues and manure into the surface layer will help maintain organic matter content.

When this soil is used for pasture, overgrazing or grazing when wet are major concerns of management. If the pasture is grazed when wet, the surface soil will become compacted and the structure destroyed. Proper stocking rates and rotation of pastures will prevent overgrazing and help maintain key plant species. Optimum production requires maintenance of fertility through periodic applications of nutrients.

The potential is high for water-tolerant trees. Removal of undesirable species increases production. Woodland harvesting activities are limited by flooding and the high water table.

This soil has limitations for nonfarm uses because of flooding and the high water table. These are serious limitations for homesites, onsite waste disposal, and road construction. The capability subclass is III<sub>lw</sub>; woodland ordination symbol is 2w.

**KnB—Klinesville shaly silt loam, 3 to 8 percent slopes.** This gently sloping, shallow, well drained soil is on dissected uplands. Slopes are convex, about 400 to 800 feet long, and uniform. They are dissected on drainageways. The areas are wide and irregular in shape and about 5 to 25 acres in size.

Typically, the surface layer is dark reddish brown shaly silt loam about 6 inches thick. The subsoil is reddish brown very shaly silt loam to a depth of 10 inches. The substratum is weak red, very shaly silt loam to a depth of 14 inches. Dusky red, highly fractured bedrock is below a depth of 14 inches.

Included with this soil in mapping are a few areas of Weikert, Berks, and Calvin soils; scattered areas of

nearly level Klinesville soils; and severely eroded soils associated with spring seeps that are not as well drained as this Klinesville soil.

This soil has moderately rapid permeability and very low available water capacity. Surface runoff is medium. The surface layer is more than 15 percent shale. In unlimed areas, reaction is very strongly acid to medium acid.

Most areas are cultivated. Small areas are used for trees or homesites. The potential is fair for cultivated crops; this soil is fairly suited to pasture and trees. The potential for homesites is fair, but the shallow depth to bedrock will present problems for onsite waste disposal. There are also limitations for most other nonfarm uses.

If this soil is cultivated, there is a moderate hazard of erosion. Further erosion will result in a shallower rooting depth and lower available water capacity. Crops respond well to fertilizer and good management. Runoff can be reduced and erosion controlled by minimum tillage, use of cover crops, and including grasses and legumes in the cropping system. Incorporating crop residues and manure into the surface layer will help maintain organic matter content and reduce the tendency of the soil to clod and crust. The shaly surface layer may interfere with the seeding of small grain and the mechanical harvesting of some crops.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pastures are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

A few acres of this soil are wooded. Potential productivity is moderate, but rooting depth is restricted by the shale bedrock. A major management problem is a moderate seedling mortality rate because of very low available water capacity. Machine planting in large areas is generally practical.

This soil has limitations for nonfarm uses because of the shallow depth to bedrock and the moderately rapid permeability. The shallow depth to underlying bedrock is a serious limitation for onsite disposal of waste. Excavating for buildings may also be a problem. When this soil is disturbed for construction, special management is needed to control erosion and sediment. The capability subclass is IIIe; woodland ordination symbol is 4d.

**KnC—Klinesville shaly silt loam, 8 to 15 percent slopes.** This sloping, shallow, well drained soil is on dissected uplands. Slopes are convex, about 350 to 700 feet long, and uniform. They are dissected by drainageways. The areas vary in shape and are about 3 to 70 acres in size.

Typically, the surface layer is dark reddish brown shaly silt loam 6 inches thick. The subsoil extends to a depth of 10 inches. It is reddish brown very shaly silt loam. The substratum extends to a depth of 14 inches and is weak

red very shaly silt loam. Dusky red, highly fractured bedrock is at a depth of 14 inches.

Included with this soil in mapping are a few areas of Weikert, Berks, and Calvin soils; scattered areas of gently sloping Klinesville soils; and severely eroded soils associated with spring seeps that are not as well drained.

This soil has a moderately rapid permeability and very low available water capacity. Surface runoff is medium. The surface layer is more than 15 percent shale. In unlimed areas, reaction is very strongly acid to medium acid.

Most areas are cultivated. Small areas are used for trees or homesites. The potential is poor for cultivated crops and is only fair for pasture and trees. The potential for homesites is poor. The shallow depth to bedrock will present problems for onsite waste disposal. There are also limitations for many other nonfarm uses.

If this soil is cultivated, there is a severe hazard of erosion. Further erosion will result in a shallower rooting depth and lower available water capacity. This soil is suited to only a few cultivated crops because of the severe erosion hazard and the shallow depth to bedrock. Crops respond well to fertilizer and good management. Runoff can be reduced and erosion controlled by minimum tillage, diversions, use of cover crops, and including grasses and legumes in the cropping system. Incorporating some crop residues and manure into the surface layer will help maintain organic matter content and reduce the tendency of the soil to clod and crust. The shaly surface layer may interfere with the seeding to small grain and the mechanical harvesting of some crops.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pastures are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

A few acres are wooded. Potential productivity is moderate, but rooting depth is restricted by the shale bedrock. A major management problem is a moderate seedling mortality rate because of very low available water capacity. Machine planting in large areas is generally practical.

There are limitations for nonfarm uses because of the shallow depth to bedrock and moderately rapid permeability. The shallow depth to underlying bedrock is a serious limitation for onsite disposal of waste. Excavating for buildings may also be a problem. When this soil is disturbed for construction, special management is needed to control erosion and sediment. The capability subclass is IVe; woodland ordination symbol is 4d.

**KnD—Klinesville shaly silt loam, 15 to 25 percent slopes.** This moderately steep, shallow, well drained soil is on dissected uplands. Slopes are convex, about 300 to 600 feet long, and uniform. They are dissected by

drainageways. The areas vary in shape and are about 2 to 70 acres in size.

Typically, the surface layer is dark reddish brown shaly silt loam about 6 inches thick. The subsoil extends to a depth of 10 inches. It is reddish brown very shaly silt loam. The substratum extends to a depth of 14 inches and is weak red very shaly silt loam. Dusky red, highly fractured bedrock is below a depth of 14 inches.

Included in mapping are small areas of Weikert, Berks, and Calvin soils; scattered areas of sloping Klinesville soils; and severely eroded soils associated with spring seeps that are not as well drained as this Klinesville soil.

This soil has moderately rapid permeability and very low available water capacity. Surface runoff is medium. The surface layer is more than 15 percent shale. In unlimed areas, reaction is very strongly acid to medium acid.

Most areas are cultivated. Small areas are used for trees or homesites. The potential is poor for cultivated crops; this soil is better suited to hay and trees. The potential for homesites is poor. The shallow depth to bedrock and slope are limitations for onsite waste disposal. There are also limitations for most other nonfarm purposes.

This soil is not suited to cultivated crops because of the very severe hazard of erosion. It is better suited to grass. Further erosion will result in a shallower rooting depth and lower available water capacity.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pastures are the chief management needs. Rotation of pastures and restricted grazing are needed. Optimum production requires maintenance of fertility through periodic applications of nutrients.

A few acres are wooded. Potential productivity is moderate, but rooting depth is restricted by the shale bedrock. A major management problem is moderate seedling mortality because of the very low available water capacity. Moderately steep slope influences equipment selection. Machine planting may be difficult because of slope.

This soil has limitations for nonfarm uses because of the moderately steep slope, shallow depth to bedrock, and the moderately rapid permeability. The slope and shallow depth of underlying bedrock are serious limitations for onsite disposal of waste. Excavating for buildings is also a problem. When this soil is disturbed for construction, management practices are needed to control erosion and sediment. The capability subclass is VIe; woodland ordination symbol is 4d.

**LaB—Laidig channery loam, 3 to 8 percent slopes.**

This gently sloping, deep, well drained, soil is on foot slopes and the tops of convex ridges on uplands. Slopes are 300 to 1,000 feet long and uniform. The areas are irregular and broad in shape and commonly about 5 to 80 acres in size.

Typically, the surface layer is dark brown channery loam, about 7 inches thick. The subsoil extends to a depth of 80 inches. It is yellowish brown channery loam and strong brown channery heavy loam to a depth of 31 inches. Below that is a fragipan of mottled, yellowish red channery sandy clay loam that is firm and brittle.

Included with this soil in mapping are small areas of Buchanan soils and nearly level Laidig soils. Also included are scattered areas where the subsoil is yellowish red and red.

This soil has moderate to moderately rapid permeability in the surface layer and upper part of the subsoil. Permeability is moderately slow in the fragipan. Available water capacity is moderate. Surface runoff is medium. Rooting depth is restricted by the dense fragipan. Reaction is strongly acid to extremely acid.

This soil is used mainly for cultivated crops. A few areas are used for hay or pasture. Other areas are in woods or used for homesites and recreation. This soil is well suited to cultivated crops, hay, pasture, and trees. The potential for homesites is good, but moderately slow permeability will present problems for onsite waste disposal. The channery surface is a limitation for many other nonfarm uses.

When the soil is cultivated, there is a moderate erosion hazard. Runoff can be reduced and erosion controlled by minimum tillage, use of cover crops, including grasses and legumes in the cropping system, stripcropping, and diversions. Incorporating crop residues and manure into the surface layer will help maintain organic matter content.

This soil is well suited to pasture. Proper stocking rates to maintain key plant species and rotation of pastures are the chief management needs. Optimum production requires maintenance of fertility through periodic application of nutrients.

This potential is moderately high for trees, although all but a few areas have been cleared. Machine planting is generally practical on large areas.

There are some limitations for nonfarm uses because of the moderately slowly permeable subsoil and channery surface. The moderately slowly permeable subsoil is a serious limitation for onsite waste disposal. Buildings with basements should have foundation drains with proper outlets to prevent seepage into the basements. When this soil is disturbed for construction, special management is needed to control erosion and sediment. The capability subclass is IIe; woodland ordination symbol is 3o.

**LaC—Laidig channery loam, 8 to 15 percent slopes.** This sloping, deep, well drained soil is on convex side slopes on uplands. Slopes are commonly parallel to the mountain or to drainageways on foot slopes. They are about 300 to 900 feet in length. The areas are wide and irregular in shape. They range from 5 to 90 acres in size.



Typically, the surface layer is dark brown channery loam about 7 inches thick. The subsoil extends to a depth of 80 inches. It is yellowish brown and strong brown channery loam and channery heavy loam to a depth of 31 inches. Below that is a fragipan of mottled, yellowish red, channery sandy clay loam that is firm and brittle.

Included with this soil in mapping are small areas of Buchanan and Hazleton soils and gently sloping and moderately steep Laidig soils. Also included are scattered areas where the subsoil is yellowish red and red.

This soil has moderate to moderately rapid permeability in the surface layer and upper part of the subsoil but moderately slow permeability in the fragipan. Available water capacity is moderate. Surface runoff is medium. Rooting depth is restricted by the dense fragipan. Reaction is strongly acid to extremely acid.

This soil is used mainly for cultivated crops. A few areas are used for hay or pasture. Other areas are in woods or used for homesites and recreation. This soil is well suited to cultivated crops, hay, pasture, and trees. The potential for homesites is fair, but the moderately slow permeability will present problems for onsite waste disposal. There are limitations for many other nonfarm uses because of the channery surface.

When the soil is cultivated, there is a severe erosion hazard. Further erosion will result in a shallower rooting depth and low available water capacity. Runoff can be reduced and erosion controlled by minimum tillage, use of cover crops, including grasses and legumes in the cropping system, stripcropping, and diversions. Incorporating crop residues and manure into the surface layer will help maintain organic matter content.

This soil is well suited to pasture. Proper stocking rates to maintain key plant species and rotation of pastures are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

The potential for trees is moderately high. Although all but a few areas have been cleared. Machine planting in large areas is generally practical.

This soil has limitations for nonfarm uses because of the dense, moderately slowly permeable fragipan, channery surface, and slope. The moderately slow permeability is a serious limitation for onsite waste disposal. Buildings with basements should have foundation drains with proper outlets to prevent seepage into the basements. When this soil is disturbed for construction, management practices are needed to control erosion and sediment. The capability subclass is IIIe; woodland ordination symbol is 3o.

**LdB—Laidig extremely stony loam, 3 to 8 percent slopes.** This gently sloping, deep, well drained soil is on foot slopes, small benches, and tops of convex ridges on mountains. Slopes are 400 to 1,200 feet in length and uniform. The areas are irregular in shape and range from

about 5 to 50 acres in size. Large stones cover about 15 to 50 percent of the surface.

Typically, the surface layer is very dark grayish brown channery loam about 3 inches thick. The subsurface layer is grayish brown channery loam to a depth of 7 inches. The subsoil extends to a depth of 80 inches. It is yellowish brown channery loam and strong brown channery heavy loam to a depth of 31 inches. Below that is a fragipan of yellowish red channery sandy clay loam that is firm and brittle.

Included with this soil in mapping are small areas of Buchanan soils, Hazleton soils, small spring seeps, and areas of Rubble land. Also included are areas where the subsoil is yellowish red and red.

This soil has moderate to moderately rapid permeability in the surface layer and upper part of the subsoil but moderately slow permeability in the fragipan. Surface runoff is medium. Plant rooting depth is restricted by the dense fragipan. Reaction is strongly acid to extremely acid.

Most areas are in woodland and are state owned. This soil is too stony for cultivated crops. A small acreage in the Blue and Second Mountains is used for military training. The potential for many nonfarm uses is poor because of the surface stones.

This soil is too stony for cultivated crops and pasture. The stones are too large and numerous to be economically removed. The potential is moderately high for trees. Removal of undesirable species will improve production. Construction of logging roads on the contour is a good management practice. Large stones interfere with harvesting and mechanical planting.

This soil has serious limitations for most nonfarm uses because of the numerous surface stones and the moderately slow permeability in the subsoil. The capability subclass is VIIi; woodland ordination symbol is 3x.

**LdC—Laidig extremely stony loam, 8 to 25 percent slopes.** This sloping to moderately steep, deep, well drained soil is on mountainsides and near ridgetops. Slopes parallel the mountains and are about 400 to 1,200 feet in length. The areas are irregular in shape and are 10 to 300 acres in size. Large stones cover about 15 to 50 percent of the surface.

Typically, the surface layer is very dark grayish channery loam about 3 inches thick. The subsurface layer is grayish brown channery loam to a depth of 7 inches. The subsoil extends to a depth of 80 inches. It is yellowish brown channery loam and strong brown channery heavy loam to a depth of 31 inches. Below that is a fragipan of yellowish red channery sandy clay loam that is firm and brittle.

Included with this soil in mapping are small areas of Buchanan soils, Hazleton soils, spring seeps, Rubble land, and Rock outcrop. Also included are areas where the subsoil is yellowish red and red.

This soil has moderate to moderately rapid permeability in the surface layer and upper part of the subsoil but moderately slow permeability in the fragipan. Surface runoff is medium to rapid. Rooting depth is somewhat restricted by the dense fragipan. Reaction is strongly acid to extremely acid.

Most areas are in woodland. This soil is too stony for cultivated crops. The stones are too numerous and large to be economically removed. Most areas are state owned. A small acreage in the Blue and Second Mountains is used for military training. The potential for nonfarm uses is poor because of the surface stones and moderately slow permeability.

This soil is too stony for cultivated crops and pastures. The stones are too large and numerous to be economically removed.

The potential is moderately high for trees. Removal of undesirable species will improve production. Constructing logging roads on the contour is a good way to help control erosion during harvesting.

This soil has severe limitations for most nonfarm uses because of the numerous surface stones, the moderately slow permeability in the subsoil, and slope. The capability subclass is VII<sub>s</sub>; woodland ordination symbol is 3x.

**LeB—Leck Kill shaly silt loam, 3 to 8 percent slopes.** This gently sloping, deep, well drained soil is commonly on the upper parts of convex slopes on dissected uplands. Slopes are 300 to 800 feet in length and uniform. The areas are wide and irregular in shape and are about 5 to 15 acres in size.

Typically, the surface layer is dark reddish brown shaly silt loam about 10 inches thick. The subsoil extends to a depth of 48 inches. It is reddish brown shaly silty clay loam. The substratum is reddish brown very shaly silt loam to a depth of 70 inches.

Included in mapping are small areas of Klinesville, Berks, Calvin, Abbottstown, and Comly soils. Also included are small wet areas and nearly level Leck Kill soils.

This soil has moderate and moderately rapid permeability and low available water capacity. Surface runoff is medium. The surface layer is 15 percent or more shale. In unlimed areas the soil is very strongly acid or strongly acid in the surface layer and subsoil.

Most areas are cultivated, but a few are in hay or pasture. Other areas are in trees or are used for homesites. The potential is good for cultivated crops. This soil is also suited to trees and pasture. It has limitations for some nonfarm uses because of the shaly surface layer and bedrock at a depth of 3-1/2 to 6 feet.

When this soil is cultivated, there is a moderate erosion hazard. Surface runoff can be reduced and erosion controlled by minimum tillage, use of cover crops, strip-cropping, diversions, and including grasses and legumes in the cropping system. Incorporating crop residues and manure into the surface layer will help maintain organic matter content.

This soil is well suited to pasture. Proper stocking rates to prevent overgrazing, maintaining key plant species, and rotation of pastures are chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a very small acreage is wooded. Potential productivity is moderately high. Management problems are slight. Machine planting is practical on large areas.

This soil has a limitation for some nonfarm uses because of the shaly surface layer, bedrock at a depth of 3-1/2 to 6 feet, and moderately rapid permeability. The depth to bedrock in places is a limitation for onsite waste disposal. When this soil is disturbed for construction, special management is needed to control erosion and sediment. The capability subclass is II<sub>e</sub>; woodland ordination symbol is 3o.

**LeC—Leck Kill shaly silt loam, 8 to 15 percent slopes.** This sloping, deep, well drained soil is on dissected uplands. Slopes are about 300 to 800 feet in length and are convex. The areas are irregular in shape and about 5 to 100 acres in size.

Typically, the surface layer is dark reddish brown shaly silt loam about 12 inches thick. The subsoil extends to a depth of 48 inches. It is reddish brown shaly silty clay loam. The substratum is reddish brown very shaly silt loam to a depth of 70 inches.

Included in mapping are small areas of Calvin, Klinesville, and Weikert soils; gently sloping and moderately steep Leck Kill soils; very stony areas; and small wet areas.

This soil has moderate to moderately rapid permeability and low available water capacity. Surface runoff is medium. The surface layer is 15 percent or more shale. Reaction in unlimed areas is very strongly acid or strongly acid in the surface layer and subsoil.

Most areas are used for cultivated crops, hay, and pasture. A few areas are used for homesites and trees. The potential is good for cultivated crops. This soil is also suited to pasture and trees. There are limitations for most nonfarm uses because of slope, shaly surface layer, and bedrock at a depth of 3-1/2 to 6 feet.

When this soil is cultivated, there is a moderate erosion hazard. Surface runoff can be reduced and erosion controlled by minimum tillage, use of cover crops, strip-cropping, diversions, and including grasses and legumes in the cropping system. Incorporating crop residues and manure into the surface layer will help maintain organic matter content.

This soil is well suited to pasture. Rotation of pastures and proper stocking rates to prevent overgrazing and help maintain key plant species are chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a very small acreage is wooded. Potential productivity is moderately high.



Management problems are slight. Machine planting is practical on large areas.

This soil has limitations for most nonfarm uses because of depth to bedrock in places and moderately rapid permeability. The moderately rapid permeability and depth to bedrock in places are limitations for onsite waste disposal. When this soil is disturbed for construction, special management is needed to control erosion and sediment. The capability subclass is IIIe; woodland ordination symbol is 3o.

**LfC—Leck Kill very stony silt loam, 8 to 25 percent slopes.** This sloping and moderately steep soil is on dissected side slopes and foot slopes of mountains. The areas are wide and irregular in shape. Slopes are about 400 to 1,200 feet in length and uniform. The areas are generally parallel to the mountains, but some are parallel to streams. They are about 10 to 700 acres in size. Stones cover about 3 to 15 percent of the surface.

Typically, the surface layer is dark reddish brown shaly silt loam about 7 inches thick. The subsoil extends to a depth of 48 inches. It is reddish brown shaly silty clay loam. The substratum to a depth of 70 inches is reddish brown very shaly silt loam. Bedrock is at a depth of 70 inches.

Included in mapping are small areas of Calvin and Klinesville soils, nearly level to moderately steep Laidig or Buchanan soils that have an extremely stony surface, and small wet areas.

This soil has moderate to moderately rapid permeability and low available water capacity. Surface runoff is rapid. Reaction in unlimed areas is very strongly or strongly acid in the surface layer and subsoil.

Areas are used almost exclusively for woodland and wildlife habitat. Most are state owned. A few areas are used for homesites and recreation. The potential for nonfarm use is fair because of the surface stones.

This soil is too stony for cultivated crops and pasture. The stones are too large and numerous to be economically removed.

The potential is moderately high for trees. Removal of undesirable species will improve production. Construction of logging roads on the contour is a good way to help control erosion.

This soil has limitations for most nonfarm uses because of the surface stones, bedrock at a depth of 3-1/2 to 6 feet, and moderately rapid permeability. The capability subclass is VIe; woodland ordination symbol is 3r.

**LhB—Lehigh silt loam, 2 to 10 percent slopes.** This nearly level to sloping, moderately well drained and somewhat poorly drained soil is on lower foot slopes on uplands. Slopes are smooth and convex and are 100 to 500 feet long. Areas are irregular in shape and about 2 to 44 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil extends to a

depth of about 28 inches. It is dark brown channery silt loam to a depth of 14 inches. The next layer is mottled, dark grayish brown channery silty clay loam in the upper part and dark gray channery silt loam in the lower part. The substratum to a depth of 42 inches is mottled, dark grayish brown very channery silt loam. Porcelanite bedrock is at a depth of 42 inches.

Included with this soil in mapping are small areas of Brecknock and Neshaminy soils.

This soil has slow permeability and moderate available water capacity. Surface runoff is medium. In unlimed areas, reaction is medium acid to strongly acid.

Most areas are cultivated. Small areas are used for homesites and trees. The potential is fair for cultivated crops. This soil is suited to pasture and trees.

It has limitations for many nonfarm uses because of the seasonal high water table and slow permeability. The potential for water-tolerant grasses or trees is good.

When this soil is cultivated, there is a moderate hazard of erosion. Open and closed drains are needed to remove excess water and allow timely tillage. Diversions may be needed to intercept runoff from higher slopes. Minimum tillage, grassed waterways and diversions will help to reduce runoff and control erosion. Growing cover crops, utilizing crop residue and manure, and including grasses and legumes in the cropping system are ways of maintaining organic matter content and good tilth.

This soil is suited to pasture. Overgrazing and grazing when this soil is wet are major concerns of management. If grazed when wet, the surface layer compacts and the structure is destroyed, surface runoff is increased, and erosion becomes excessive. Proper stocking rates, rotation of pasture, deferment of grazing, and restricted grazing during wet periods will help maintain key plant species. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a small acreage is wooded. Potential productivity is moderately high. Equipment limitation is a concern of management. The use of equipment is restricted for short periods during wet seasons. Machine planting on the larger areas is practical.

This soil has limitations for most nonfarm uses because of slow permeability and seasonal high water table. These are serious limitations for onsite disposal of waste. Buildings with basements should have foundation drains with proper outlets to prevent seepage into the basements. The capability subclass is IIIw; woodland ordination symbol is 3w.

**Ls—Lindside silt loam.** This nearly level, moderately well drained soil is on flood plains and upland drainageways. It formed in recent alluvium originating from limestone material. The slopes are smooth, slightly convex, and 100 to 200 feet long. Areas are irregular in shape and about 2 to 145 acres in size.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 42

inches. It is dark brown silt loam to a depth of 17 inches. Below that is mottled dark brown silt loam. The substratum to a depth of 60 inches is mottled dark grayish brown stratified fine sandy loam and silt loam.

Included with this soil in mapping are small intermingled areas of Melvin Variant soils and Lindsides soils that have a gravelly and cobbly surface.

This soil has moderate to moderately slow permeability and high available water capacity. Surface runoff is medium. The soil is subject to flooding. Streambank erosion and gouging occur during floods. In unlimed areas the soil is strongly acid to slightly acid in the surface layer and upper part of the subsoil and medium acid to neutral in the lower part of the subsoil.

The potential is good for farming and woodland. Most areas of this soil are used for pasture. A few scattered areas are in trees. This soil is limited for many nonfarm uses because of flooding and seasonal high water table.

This soil is suited to cultivated crops. Tillage should be done after floodwaters have receded enough to allow for proper tillage. The erosion hazard is severe at the streambank. Streambank stabilization and soil drainage are the major concerns in management. Open and closed drains with suitable outlets may be needed to remove excess water. Incorporating manure and crop residues into the surface layer will help maintain organic matter content and good tilth.

When this soil is used for pasture, overgrazing and grazing on this soil when it is wet are major concerns of management. Rotation of pastures, restricted grazing, and proper stocking rates are management practices that can be used to prevent overgrazing and maintain key plant species. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is well suited to trees, but only a few acres are wooded. Potential productivity is high. Management problems are related to flooding. The use of equipment is restricted for short periods in wet seasons and during floods. Machine planting is practical on larger areas.

There are limitations for most nonfarm uses because of flooding and the seasonal high water table. These are serious limitations for homesites, onsite waste disposal, and road construction on this soil. The capability subclass is IIw; woodland ordination symbol is 1w.

**MaA—Markes silt loam, 0 to 5 percent slopes.** This nearly level and gently sloping, moderately deep, poorly drained soil is on broad upland flats and foot slopes. Slopes are 100 to 700 feet in length. The areas are wide and irregular in shape and normally range from 2 to 150 acres in size.

Typically, this soil has a dark grayish brown silt loam surface layer about 7 inches thick. The subsoil extends to a depth of 22 inches. It is mottled light olive gray shaly silty clay loam to a depth of 15 inches. Below that is mottled, grayish brown very shaly silty clay loam. The

substratum to a depth of 31 inches is mottled, light olive gray very shaly silty clay loam. Dark grayish brown fractured shale bedrock is at a depth of 31 inches.

Included with this soil in mapping are some small areas of Comly and Brinkerton soils.

This soil has slow permeability and high available water capacity. Reaction in unlimed areas is strongly acid in the surface layer and very strongly to medium acid in the subsoil. The soil has a water table at or near the surface for most of the year. Surface runoff is slow. The rooting depth is restricted by the high water table and moderate depth to bedrock.

Most areas are in pasture. This soil is fairly suited to crops and is better suited to pasture and moisture-tolerant trees. The potential is poor for homesites because of the depth to bedrock, slow permeability, and high water table. Depth to bedrock, high water table, and slow permeability are serious limitations for onsite waste disposal. The potential is poor for most other nonfarm uses.

This soil can be cultivated occasionally if adequately drained. Open and closed drains where outlets are available will help remove excess water. Incorporating manure and crop residue into the surface layer will help maintain the organic matter content and good tilth.

When this soil is used for pasture, overgrazing or grazing on this soil when it is wet are major concerns of management. If the pasture is grazed when wet, the surface layer of the soil will become compacted. Restricted grazing is needed during wet periods. Proper stocking rates and rotation of pastures will prevent overgrazing and help maintain key plant species. Optimum production requires maintenance of fertility through periodic applications of nutrients.

The potential is moderate for moisture-tolerant trees. The rooting depth is restricted by the bedrock and high water table. Removal of undesirable species will increase production. Use of equipment is restricted part of the year by the high water table.

This soil is limited for most nonfarm uses because of the high water table, slow permeability, and moderate depth to bedrock. The capability subclass is IVw; woodland ordination symbol is 4w.

**Me—Melvin Variant silt loam.** This nearly level, deep, poorly drained soil is on flood plains adjacent to the small, meandering, relatively shallow streams in the limestone valley. It formed in sediments washed from nearby uplands underlain by limestone and calcareous shale. Slopes are about 100 to 500 feet in length and are uniform. The areas are narrow to wide and range from about 6 to 150 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil extends to a depth of 25 inches. It is mottled olive gray silt loam to a depth of 22 inches. Below that is mottled, dark gray silt loam. The substratum to a depth of 60 inches is mottled olive gray gravelly loam.

Included in mapping are small areas of Lindside and Holly soils, Melvin Variant soils that have a gravelly surface layer and gently sloping Melvin Variant soils, and gouged areas.

This soil has moderate permeability, and the available water capacity is high. Streambank erosion and gouging occur during floods. Reaction is slightly acid or neutral throughout.

Most areas are in pasture, trees, or idle land. This soil has limited use for cultivated crops because of flooding and the high water table. It is better suited to pasture or trees. The potential is poor for most nonfarm uses.

When properly drained this soil may be used occasionally for row crops. Crops may be damaged by floodwater after intensive rainfall (fig. 7). Excess water causes the soil to warm slowly in spring. Excess surface water can be drained away by keeping natural drainageways open. Open drains, where outlets are available, can be used to improve drainage.

When this soil is used for pasture, overgrazing when the soil is wet are chief concerns of management. If the pasture is grazed when wet, the surface layer will become compacted and its structure destroyed. Proper stocking rates and rotation of pastures will prevent overgrazing and help maintain key plant species. Optimum production requires maintenance of fertility through periodic applications of nutrients.

The potential is very high for water-tolerant trees. Removal of undesirable species will increase production. Use of equipment is restricted part of the year because of the high water table. Machine planting is practical on the larger areas.

This soil has limitations for most nonfarm uses because of flooding and a high water table. Flooding and high water table are serious limitations for homesites and onsite waste disposal. The capability subclass is IIIw; woodland ordination symbol is 1w.

**MoB—Mount Lucas silt loam, 3 to 8 percent slopes.** This gently sloping, deep, moderately well



Figure 7.—Crops on Melvin Variant silt loam are subject to flooding when shallow streams overflow their banks during heavy rainfall.

drained and somewhat poorly drained soil is on upland flats and concave lower side slopes. Slopes are smooth and convex and are 100 to 350 feet long. Areas are elongated and irregular in shape and are about 2 to 17 acres in size.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil extends to a depth of 35 inches. It is yellowish brown silt loam to a depth of 15 inches. The lower 20 inches is mottled brown channery silty clay loam. The substratum to a depth of 60 inches is mottled, brown very channery silt loam.

Included with this soil in mapping are small intermingled areas of Mount Lucas soils that have an extremely stony surface and Brecknock, Lehigh, and Neshaminy soils.

This soil has moderately slow and slow permeability and high available water capacity. Surface runoff is medium. This soil has a seasonal high water table within 6 to 36 inches of the surface during wet seasons. Tilth is poor, and the soil tends to dry out slowly in the spring. In unlimed areas, the surface layer and upper part of the subsoil ranges from strongly acid to slightly acid, and the lower part of the subsoil from medium acid to neutral.

Most areas are cultivated. Small areas are used for homesites and trees. The potential is fair for farming; this soil is suited to pasture and trees. The potential for homesites is poor because of the moderately slowly permeable and slowly permeable subsoil and seasonal high water table. There are limitations for most nonfarm uses.

This soil is fairly suited to cultivated crops. Maintaining good tilth in cultivated areas is difficult. The hazard of erosion is moderate, and control of erosion and wetness is a major concern of management. Open and closed drains are needed to remove excess water and allow for timely tillage. Stripcropping, minimum tillage, diversions, sod waterways, and use of cover crops will help reduce runoff and control erosion. Maintaining the content of organic matter and improving the tilth are also concerns of management.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pastures are the chief management needs. Overgrazing or grazing when this soil is wet are also major concerns. If this soil is grazed when wet, the surface layer will become compacted. Rotation of pasture, deferment of grazing, and restricted grazing during wet periods will help maintain key plant species. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a small acreage is wooded. Potential productivity is high. The use of equipment is restricted for short periods during wet seasons. Machine planting is practical on the larger areas.

There are severe limitations for most nonfarm uses because of moderately slow or slow permeability and a seasonal high water table. These are serious limitations for onsite disposal of waste and for buildings with base-

ments. Foundation drains will help reduce the hazard of flooded basements. The capability subclass is IIe; woodland ordination symbol is 2w.

**MsB—Mount Lucas extremely stony silt loam, 3 to 8 percent slopes.** This very nearly level to gently sloping, moderately well drained and somewhat poorly drained soil is on upland flats and on concave lower foot slopes. Slopes are smooth and convex and are 100 or more feet long. Areas are irregular in shape and about 6 to 61 acres in size. Large stones cover about 15 to 50 percent of the surface.

Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil extends to a depth of 35 inches. It is yellowish brown silt loam to a depth of 15 inches. The lower 20 inches, is mottled, brown channery silty clay loam. The substratum to a depth of 60 inches is mottled, brown very channery silt loam.

Included with this soil in mapping are small intermingled areas of Neshaminy and Watchung soils.

This soil has moderately slow and slow permeability and high available water capacity. Runoff is medium. This soil has a seasonal high water table within 6 to 36 inches of the surface during wet seasons. In unlimed areas, reaction ranges from strongly acid to slightly acid in the surface layer and upper part of the subsoil and from medium acid to neutral in the lower part of the subsoil.

Most areas are in woodland. A few areas are used for homesites. The potential is poor for farming. The potential is limited for most nonfarm uses, mainly because of the extremely stony surface, moderately slow and slow permeability and seasonal high water table. The potential is good for trees and wildlife habitat.

This soil is not suited to cultivated crops and pasture because of the extremely stony surface. The stones are too large and numerous to be economically removed.

This soil is suited to trees. Potential productivity is high, but the rooting depth is restricted by the seasonal high water table. The use of equipment is limited by the numerous surface stones and is restricted for short periods during wet seasons.

There are limitations for most nonfarm uses because of the extremely stony surface and moderately slow or slow permeability. Moderately slow and slow permeability, surface stones, and the seasonal high water table are serious limitations for onsite disposal of waste. The capability subclass is VIIs; woodland ordination symbol is 2x.

**MuB—Murrill gravelly silt loam, 3 to 8 percent slopes.** This gently sloping, deep well drained soil is on foot slopes and benches of mountains. Slopes are smooth and convex and are 100 to 700 feet long. Areas are wide and irregular in shape and mainly about 4 to 60 acres in size.

Typically, the surface layer is dark brown gravelly silt loam about 10 inches thick. The subsoil extends to a depth of 62 inches. It is yellowish brown, channery silty clay loam to a depth of 21 inches. Below that is 15 inches of strong brown channery clay loam over 20 inches of yellowish brown channery sandy clay loam. The lower subsoil is clay loam with mixed strong brown and reddish brown with yellow and red mottles.

Included with this soil in mapping are small intermingled areas of steeper Murrill soils and a few areas of Duffield, Chester, and Buchanan soils.

This soil has moderate permeability and high available water capacity. Surface runoff is medium. In unlimed areas, reaction is medium acid to very strongly acid.

Most areas are cultivated. Small areas are used for woodland and homesites. The potential is excellent for cultivated crops; this soil is well suited to pasture and trees. The potential for homesites is good, but sinkholes and possible ground water contamination may be limitations for onsite waste disposal. There are some limitations for most other nonfarm uses because of the gravelly surface and sinkholes.

When this soil is cultivated, there is a moderate hazard of erosion. Control of erosion and maintaining the organic matter content are the chief management needs. Stripcropping, diversions, and minimum tillage can help control erosion. Use of cover crops, including grasses and legumes in the cropping system, and incorporating crop residues and manure into the surface layer will help maintain the organic matter content.

When this soil is used for pasture, maintaining key plant species and optimum production are the chief management needs. Proper stocking rates and rotation of pasture will prevent overgrazing and help maintain key plant species. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a small acreage is wooded. Potential productivity is moderately high. Machine planting is practical on larger areas.

There are limitations for many urban uses because of the gravelly surface layer and sinkholes. Ground water contamination is a possible hazard for onsite waste disposal, and sinkholes are possible hazards for buildings. The capability subclass is 11e; woodland ordination symbol is 30.

**NeB—Neshaminy gravelly silt loam, 3 to 8 percent slopes.** This gently sloping, deep, well drained soil is on lower side slopes and tops of ridges. Slopes are smooth and convex and more than 100 feet long. Areas are oval in shape and about 2 to 14 acres in size.

Typically, the surface layer is dark brown gravelly silt loam about 9 inches thick. The subsoil extends to a depth of 44 inches. It is yellowish red clay loam to a depth of 30 inches. The lower 14 inches is red gravelly loam. The substratum to a depth of 60 inches is strong brown gravelly sandy loam.

Included with this soil in mapping are small intermingled areas of sloping Neshaminy soils and areas of Chester and Berks soils.

This soil has moderately slow permeability and moderate available water capacity. Runoff is medium. Tilth is good, and the root zone extends to a depth below 50 inches. In unlimed areas, reaction is very strongly acid to medium acid in the upper part of the surface layer and upper part of the subsoil and strongly acid or medium acid in the lower part of the subsoil.

Most areas are cultivated. Small areas are used for homesites and trees. The potential is very good for cultivated crops; this soil is suited to trees and pasture. The potential for homesites is good, but, in places, bedrock at a depth of 48 to 60 inches may present problems for onsite waste disposal.

This soil is well suited to cultivated crops. The hazard of erosion is moderate, and control of erosion and maintaining organic matter content are major concerns of management. When this soil is cultivated, minimum tillage, stripcropping, use of cover crops, and including grasses and legumes in the cropping system can reduce runoff and help control erosion.

This soil is well suited to pasture and hayland. When it is used for pasture, proper stocking rates to maintain key plant species and rotation of pasture are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is well suited to trees, but only a small acreage is wooded. Potential productivity is high. Management problems are few. Machine planting is practical on the larger areas.

There are some limitations for most nonfarm uses because of the moderately slow permeability, the moderate frost action, and depth to bedrock in places. Bedrock at a depth of 48 to 60 inches interferes with deep excavations and is a problem for onsite waste disposal. The capability subclass is 11e; woodland ordination symbol is 20.

**NeC—Neshaminy gravelly silt loam, 8 to 15 percent slopes.** This sloping, deep, well drained soil is on convex uplands. Slopes are smooth and convex and more than 100 feet long. Areas are irregular in shape and about 2 to 140 acres in size.

Typically, the surface layer is dark brown gravelly silt loam about 9 inches thick. The subsoil extends to a depth of 44 inches. It is yellowish red clay loam to a depth of 30 inches. Below that is red gravelly loam. The substratum to a depth of 60 inches is strong brown gravelly sandy loam.

Included with this soil in mapping are small intermingled areas of gently sloping and moderately steep Neshaminy soils and Chester and Berks soils.

This soil has moderately slow permeability and moderate available water capacity. Runoff is medium to rapid.

Tilth is good and the root zone extends to a depth below 50 inches. In unlimed areas reaction is very strongly acid to medium acid in the surface layer and upper part of the subsoil and strongly acid or medium acid in the lower part of the subsoil.

Most areas are cultivated. Small areas are used for homesites and trees. The potential is good for cultivated crops; this soil is well suited to pasture and trees. The potential for homesites is good, but, in places, bedrock at a depth of 48 to 60 inches may present problems for onsite waste disposal.

This soil is well suited to cultivated crops. The hazard of erosion is severe, and control of erosion and maintaining organic matter content are major concerns of management. Minimum tillage, stripcropping, diversions, use of cover crops, and including grasses and legumes in the cropping system help reduce runoff and control erosion.

This soil is well suited to pasture and hayland. Proper stocking rates to maintain key plant species and rotation of pasture are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is well suited to trees, but only a small acreage is wooded. Potential productivity is high; management problems are few. Machine planting is practical on the larger areas.

There are some limitations for most nonfarm uses because of slope, moderately slow permeability, the moderate frost action, and in places depth to bedrock. Moderately slow permeability is a serious limitation for onsite waste disposal. Bedrock at a depth of 48 to 60 inches interferes with deep excavation. The capability subclass is IIIe; woodland ordination symbol is 2o.

**NhB—Neshaminy extremely stony silt loam, 3 to 8 percent slopes.** This gently sloping, deep well drained soil is on lower side slopes and tops of ridges. Slopes are smooth and convex and are more than 100 feet long. Areas are irregular in shape and are about 4 to 250 acres in size. Large stones cover about 15 to 50 percent of the surface.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil extends to a depth of 44 inches. It is yellowish red clay loam to a depth of 30 inches. Below that it is red gravelly loam. The substratum to a depth of 60 inches is strong brown gravelly sandy loam.

Included with this soil in mapping are small intermingled areas of sloping extremely stony Neshaminy soils, gently sloping very stony Neshaminy soils, and Lehigh and Ungers extremely stony soils.

This soil has moderately slow permeability and moderate available water capacity. Runoff is medium. In unlimed areas reaction is very strongly acid to medium acid in the surface layer and upper part of the subsoil and strongly acid or medium acid in the lower part of the subsoil.

Most areas are woodland. The potential is very poor for farming and limited for many nonfarm uses. This soil is suited for trees and wildlife habitat.

This soil is too stony for cultivated crops and pasture. The stones are too large and numerous to be economically removed.

This soil is suited to trees, and most acreage is wooded. Potential productivity is high. Equipment selection is limited by the numerous surface stones.

This soil is limited for most nonfarm uses by the numerous large surface stones and moderately slow permeability. Bedrock within the minimum depth of 48 to 60 inches interferes with deep excavation. The capability subclass is VIIs; woodland ordination symbol is 2x.

**NhC—Neshaminy extremely stony silt loam, 8 to 25 percent slopes.** This sloping and moderately steep, deep, well drained soil is on ridges. Slopes are smooth and convex and more than 100 feet long. Areas are very broad and irregular in shape and about 3 to more than 1,000 acres in size. Large stones cover about 15 to 50 percent of the surface.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil extends to a depth of about 44 inches. It is yellowish red clay loam to a depth of 30 inches. The lower 14 inches is red gravelly loam. The substratum to 60 inches is strong brown gravelly sandy loam.

Included with this soil in mapping are small intermingled areas of gently sloping extremely stony and stony Neshaminy soils and Ungers extremely stony soils.

This soil has moderately slow permeability and moderate available water capacity. Runoff is medium to rapid. In unlimed areas, reaction is very strongly acid to medium acid in the surface layer and upper part of the subsoil and strongly acid or medium acid in the lower part of the subsoil.

Most areas are in woodland. The potential is very poor for farming and limited for nonfarm uses. This soil is suited to trees and wildlife habitat.

This soil is too stony for cultivated crops and pasture. The stones are too large and numerous to be economically removed.

This soil is suited to trees, and most areas are wooded. Potential productivity is high. Large surface stones interfere with harvesting and machine planting.

This soil is limited for most nonfarm uses because of the large surface stones, slopes, and moderately slow permeability. Bedrock within 48 to 60 inches of the surface interferes with deep excavation. The capability subclass is VIIs; woodland ordination symbol is 2x.

**NHE—Neshaminy extremely stony silt loam, steep.** This steep and very steep, deep, well drained soil is on sides of ridges. The composition of this map unit varies somewhat more than that of most other units in the county. Slopes are smooth and convex and more than



100 feet long. Areas are elongated and irregular in shape and about 5 to 170 acres in size. Large stones cover about 15 to 50 percent of the surface.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil extends to a depth of about 44 inches. It is yellowish red clay loam to a depth of 30 inches. Below that it is red gravelly loam. The substratum to a depth of 60 inches is strong brown gravelly sandy loam.

Included with this soil in mapping are small areas of extremely stony Neshaminy soils that have a loam surface, Rock outcrop, and Rubble land. These included areas range from 3 to 25 acres in size and may make up about 15 to 25 percent of this unit.

This soil has moderately slow permeability and moderate available water capacity. Runoff is rapid. In unlimed areas, reaction is very strongly acid to medium acid in the surface layer and upper part of the subsoil and strongly acid or medium acid in the lower part of the subsoil.

Most areas are woodland. Potential is very poor for farming and very limited for many nonfarm uses because of surface stones and slope.

This soil is suited to trees and wildlife habitat, and most of the acreage is wooded. Potential productivity is high. Equipment selection is limited by slope and numerous surface stones.

This soil is seriously limited for most nonfarm uses by slopes, numerous surface stones, and moderately slow permeability. The capability subclass is VII<sub>s</sub>; woodland ordination symbol is 2x.

**No—Nolin Variant silt loam.** This nearly level, deep, well drained soil is on flood plains and in low areas between higher slopes on uplands. Slopes are smooth and concave and several hundred feet long. Areas are narrow and elongated and about 3 to 84 acres in size.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil is dark yellowish brown silt loam to a depth of 31 inches. The substratum to a depth of 35 inches is dark yellowish brown gravelly fine sandy loam. Below that, to a depth of 60 inches, it is brown gravelly loam.

Included in mapping are small areas of Lindside, Clarksburg, and Duffield soils. Also included are small areas of Nolin Variant soils that have a loam surface layer.

This soil has moderate permeability and high available water capacity. Surface runoff is slow. Flooding is frequent and of short duration. Reaction is medium acid to neutral.

Most areas are cultivated. A few areas are used for homesites. The potential is very good for cultivated crops; this soil is well suited to pasture or trees. The potential is limited for many urban uses because of flooding.

When this soil is cultivated, maintaining the organic matter content is a chief management need. Growing cover crops and incorporating crop residues and manure into the surface layer will help maintain organic matter.

In areas that are wide enough, the potential is good for pasture. Overgrazing and grazing on this soil when it is wet are chief concerns of management. Restricted grazing and rotation of pasture are needed to prevent overgrazing and maintain key plant species. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a very small acreage is wooded. Potential productivity is very high. The use of equipment is restricted for short periods during floods. Machine planting is practical on larger areas.

This soil has limitations for most nonfarm uses because of flooding. Flooding is a serious limitation for homesites and onsite waste disposal. The capability class is I; woodland ordination symbol is 1o.

**PeB—Penn shaly silt loam, 3 to 8 percent slopes.**

This gently sloping, moderately deep, well drained soil is on dissected rolling uplands. Slopes are 300 to 700 feet in length and uniform. The areas are irregular in shape and about 3 to 60 acres in size.

Typically, the surface layer is reddish brown shaly silt loam about 6 inches thick. The subsoil extends to a depth of 27 inches. It is dark reddish brown shaly silt loam to a depth of 11 inches. Below that it is dusky red shaly light silty clay loam and shaly silt loam. The substratum from a depth of 27 to 32 inches is weak red shaly silt loam. Weak red shale and siltstone bedrock is at a depth of 32 inches.

Included with this soil in mapping are small areas of Klinesville soils, Bucks soils, and sloping Penn soils.

This soil has moderate to moderately rapid permeability and low to moderate available water capacity. Surface runoff is slow. In unlimed areas, reaction is extremely acid to strongly acid in the surface layer and upper part of the subsoil, strongly acid or medium acid in the lower part of the subsoil, and strongly acid to slightly acid in the substratum.

Most areas are used for cultivated crops and hay. A few areas are used for pasture, trees, and homesites. This soil is suited to cultivated crops, hay, pasture, and woodland. It has limitations for many nonfarm uses because of the moderate depth to bedrock and shaly surface.

When this soil is cultivated, there is a moderate erosion hazard. Runoff can be reduced and erosion controlled by minimum tillage, use of cover crops, stripcropping, and diversions. Including grasses and legumes in the cropping system and incorporating crop residues and manure into the surface layer will help maintain organic matter content.

This soil is suited to pasture. Proper stocking rates and rotation of pastures will prevent overgrazing and

help maintain key plant species. Optimum production requires maintenance of fertility through periodic applications of nutrients.

Except in a few areas, this soil has been cleared of trees. Potential productivity is moderately high. Management problems are slight. Machine planting on larger areas is practical.

This soil has limitations for most nonfarm uses because of depth to bedrock and moderately rapid permeability. The moderate depth to rock is a serious limitation for onsite disposal of waste. Excavating for buildings may also be a problem (fig. 8). When this soil is disturbed for construction, it is necessary to control erosion

and sediment. The capability subclass is IIe; woodland ordination symbol is 3o.

**PeC—Penn shaly silt loam, 8 to 15 percent slopes.**

This sloping, moderately deep, well drained soil is on dissected, rolling uplands. Slopes are 300 to 700 feet in length and uniform. These areas are irregular in shape and about 3 to 60 acres in size.

Typically, the surface layer is reddish brown shaly silt loam about 6 inches thick. The subsoil extends to a depth of 27 inches. It is dark reddish brown shaly silt loam to a depth of 11 inches. Below that it is dusky red shaly light silty clay loam and shaly silt loam. The substratum from a depth of 27 to 32 inches is weak red shaly silt loam. Weak red shale and siltstone bedrock is at a depth of 32 inches.

Included with this soil in mapping are small areas of Klinesville soils, Bucks soils, and gently sloping and moderately steep Penn soils.

This soil has moderate to moderately rapid permeability and low to moderate available water capacity. Surface runoff is medium to rapid. In unlimed areas, reaction is extremely acid to strongly acid in the surface layer and upper part of the subsoil, strongly acid or medium acid in the lower part of the subsoil, and strongly acid to slightly acid in the substratum.

Most areas are used for cultivated crops and hay. A few areas are used for pasture, trees, and homesites. This soil is suited to cultivated crops, hay, pasture, and woodland. It has limitations for most nonfarm uses because of moderate depth to bedrock, slope, and shaly surface layer.

When this soil is cultivated, there is a moderate erosion hazard. Runoff can be reduced and controlled by minimum tillage, use of cover crops, stripcropping, and diversions. Including grasses and legumes in the cropping rotation and incorporating crop residues and manure into the surface layer will help maintain organic matter content.

When this soil is used for pasture, maintaining key plant species and organic matter are chief management needs. Proper stocking rates and rotation of pastures prevent overgrazing and to help maintain key plant species. Optimum production requires maintenance of fertility through periodic applications of nutrients.

Except in a few areas, this soil has been cleared of trees. Potential productivity is moderately high. Management problems are slight. Machine planting on larger areas is practical.

This soil has limitations for most nonfarm uses because of the depth to bedrock, slope, shaly surface, and moderately rapid permeability. The moderate depth to rock is a serious limitation for onsite disposal of waste. Excavating for buildings may also be a problem. When this soil is disturbed for construction, it is necessary to control erosion and sediment. The capability subclass is IIle; woodland ordination symbol is 3o.



*Figure 8.*—Interbedded siltstone and shale bedrock at moderate depth in Penn shaly silt loam, 3 to 8 percent slopes, may present problems in deep excavations.



**Ph—Philo silt loam.** This nearly level, deep, moderately well drained soil is on flood plains along major streams. Slopes are 200 to 400 feet in length. The areas are wide and irregular in shape and about 5 to 60 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil extends to a depth of 39 inches. It is strong brown silt loam to a depth of 24 inches and dark brown silt loam below that. The substratum to a depth of 60 inches is grayish brown silt loam.

Included with this soil in mapping are small areas of Holly soils, Pope soils, gouged areas, depressions, spring seeps, and coal wash sediment.

This soil has moderate and moderately slow permeability and high available water capacity. Surface runoff is slow. Flooding is common. The seasonal high water table is within 18 to 36 inches of the surface during wet seasons. Reaction in unlimed areas is very strongly acid to medium acid.

Most areas are cultivated. The potential is good for farming. Areas 100 to 400 feet from creeks are used for farming. Areas closest to the creeks are very narrow and are in woods or pasture.

The potential is good for cultivated crops. Crops may be damaged by floodwater following intensive rainfall. Excess surface water can be drained away by keeping natural drainageways open. Open drains with adequate outlets can improve drainage. Incorporating crop residues and manure into the surface layer will help maintain organic matter content. Diversions and covered drains where outlets are available will help remove excess water and allow for timely tillage.

When this soil is used for pasture, overgrazing or grazing on this soil when it is wet are major concerns of management. Proper stocking rates and rotation of pastures will prevent overgrazing and help maintain key plant species. Optimum production requires maintenance of fertility through periodic applications of nutrients.

The potential is very high for trees. A small acreage, mainly along streambanks, is woodland. Removal of undesirable species will increase production. Flooding and the seasonal high water table interfere with harvesting and mechanical seeding. Machine planting is practical in large areas.

This soil has limitations for nonfarm uses because of flooding and the seasonal high water table. The flooding and seasonal high water table are serious limitations for homesites, onsite waste disposal, and road construction. The capability subclass is IIw; woodland ordination symbol is 1w.

**Po—Pope loam.** This nearly level, deep, well drained soil is on flood plains along the major creeks. Slopes are 200 to 400 feet in length and uniform. The areas are narrow and irregular in shape and about 5 to 40 acres in size.

Typically, the surface layer is dark brown loam about 6 inches thick. The subsoil extends to a depth of 36 inches. It is dark brown and strong brown loam to a depth of 31 inches and strong brown gravelly fine sandy loam below that. The substratum to a depth of 62 inches is strong brown and dark brown loamy sand.

Included with this soil in mapping are small areas of Holly and Philo soils, gouged areas, depressions, spring seeps, and coal wash sediment.

This soil has moderate and moderately rapid permeability and moderate to high available water capacity. Surface runoff is slow. Flooding is common. Streambank erosion and gouging occur during floods. In unlimed areas reaction is dominantly strongly acid throughout but ranges to extremely acid.

Most areas are in trees. These areas are closest to the creeks. Areas 100 to 400 feet from the creeks are used for farming. A few areas are used for homesites. The potential is good for farming in areas not close to creeks. The potential is good for woodland but poor for many nonfarm uses because of flooding. Those areas of this soil farthest from the creeks are more suitable to farming and have excellent productivity potential. Except for flooding damage, management problems are few. Incorporating crop residues and manure into the surface layer will help maintain organic matter content.

When this soil is used for pasture, overgrazing is a major concern of management. Proper stocking rates and rotation of pastures will prevent overgrazing and help maintain key plant species. Optimum production requires maintenance of fertility through periodic applications of nutrients.

The potential is high for trees, and most areas are woodland. Removal of undesirable species will increase production. Flooding interferes with harvesting. Machine planting is practical on large areas.

This soil has limitations for many nonfarm uses because of flooding. Flooding is a serious limitation for homesites, onsite sewage waste disposal, and road construction. The capability class is I; woodland ordination symbol is 2o.

**Qu—Quarries.** This miscellaneous area is on uplands covered by surface mines from which the underlying rock has been removed. Slopes are variable and range from about 5 to 50 percent. The areas are irregular in shape and about 20 to 450 acres in size (fig. 9).

The quarry consists of the open pit and the spoil bank. The rock material mined may be limestone, coal, iron ore, quartzite, or quartzitic sandstone. The soil removed to expose the rock is either put to one side or transported to other areas. Waste rock is left within the quarry.

Included in mapping are abandoned pits filled with water, waste material, and small areas of distinctive soils.

The iron ore and quartzitic sandstone quarries have not been in operation for some time. The limestone quarries, on the other hand, are expanding. Each year additional land in the limestone valley is excavated.



Figure 9.—An area of Quarres. Limestone is quarried for roadbase, cement, and agricultural lime.

A few areas near the limestone quarries have been backfilled. Some of these areas have been returned to a grass cover, and others have been developed for shopping centers and small industrial or office buildings.

The potentials for both farming and nonfarm uses are limited. The soil and rock material used in backfill vary from place to place. Each site needs to be investigated independently to determine its limitations for an intended use. Excavated areas are unsuited to most uses. The capability subclass is not assigned; woodland ordination symbol is not assigned.

**ReB—Readington silt loam, 3 to 8 percent slopes.** This gently sloping, deep, moderately well drained soil is on lower hillsides, on upland flats, in drainageways, and at heads of streams. Slopes are smooth, slightly concave, and 100 feet or more in length. Areas are irregular in shape and about 2 to 20 acres in size.

Typically, the surface layer is reddish brown silt loam about 12 inches thick. The subsoil extends to a depth of 45 inches. It is friable yellowish red silt loam and reddish brown clay loam to a depth of 32 inches. Below that is a fragipan of reddish brown clay loam. The substratum to a depth of 60 inches is red gravelly sandy loam.

Included with this soil in mapping are a few areas of Bucks, Abbottstown, Bowmansville, and Brinkerton soils and small areas of Readington gravelly silt loam or nearly level Readington soils. Also included are spring seeps and very narrow streams.

This soil has moderately slow permeability and moderate available water capacity. Runoff is medium. This soil has a seasonal high water table within 18 to 36 inches of the surface during wet seasons. In unlimed areas, reaction is extremely acid to strongly acid in the surface layer and upper part of the subsoil and strongly acid to slightly acid in the lower part of the subsoil.

Most areas are cultivated. Small areas are used for homesites and trees. The potential is fair for cultivated crops and good for pasture and trees. Potential is limited for many nonfarm uses because of the moderately slow permeability and seasonal high water table.

When this soil is cultivated, there is a moderate hazard of erosion. Erosion control, drainage, and maintaining organic matter content are chief management needs. Minimum tillage, diversions, and strip cropping, will help control erosion. Subsurface drains may improve drainage. Use of cover crops, including grasses and legumes in the cropping system, and incorporating crop residues and manure into the surface layer will help maintain the organic matter content.

When this soil is used for pasture, overgrazing and grazing on this soil when it is wet are chief management concerns. Proper stocking rates, rotation of pasture, deferment of grazing and restricted grazing during wet periods will help maintain key plant species. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a small acreage is wooded. Potential productivity is moderately high. Machine planting is practical on the larger areas, but the use of equipment is restricted for short periods during wet seasons.

This soil has limitations for most nonfarm uses because of moderately slow permeability and seasonal high water table. These are severe limitations for onsite disposal of waste. The capability subclass is 11e; woodland ordination symbol is 3o.

**Ro—Rowland silt loam.** This deep, moderately well drained and somewhat poorly drained, nearly level soil is on flood plains. Slopes are 200 to 400 feet in length and uniform. The areas are narrow and irregular in shape and about 15 to 50 acres in size.

Typically, the surface layer is reddish brown silt loam about 8 inches thick. The subsoil extends to a depth of 37 inches. It is dark reddish brown heavy silt loam to a depth of 17 inches and reddish brown heavy silt loam and sandy clay loam below that. The substratum to a depth of 52 inches is reddish gray sandy loam. Below that, it is stratified sand and gravel.

Included with this soil in mapping are small areas of Bowmansville soils.

This soil has moderate and moderately slow permeability and low available water capacity. Surface runoff is slow. In unlimed areas reaction is very strongly acid to medium acid throughout. The soil has a seasonal high water table within 12 to 30 inches of the surface part of the year. Surface runoff is slow. Flooding is common. The rooting depth is restricted by the seasonal high water table.

Most areas are used for pasture. The areas are fairly suited to cultivated crops and pasture. The potential is very good to excellent for trees. The seasonal high water table and flooding are limitations for many nonfarm uses.

When this soil is cultivated, crops may be damaged by floodwaters following intensive rainfall. Surface water can be drained away by keeping natural drainageways open. Open drains, where outlets are available, can be used to improve drainage.

The potential is fair for pasture. Grazing on this soil when it is wet and overgrazing are major concerns of management. If the pasture is grazed when the soil is wet, the surface layer will become compacted. Proper stocking rates to maintain key plant species, rotation of pastures, deferment of grazing, and restricted grazing will prevent overgrazing and help maintain key plant species. Optimum production requires maintenance of fertility through periodic applications of nutrients.

The potential is high for trees, but the rooting depth is restricted for part of the year by the seasonal high water table. Machine planting on large areas is practical.

This soil has limitations for most nonfarm uses because of the seasonal high water table, moderately slow permeability, and flooding. The flooding and seasonal high water table are serious limitation for homesites, onsite waste disposal, and road construction. The capability subclass is IIw; woodland ordination symbol is 2w.

**Ru—Rubble land.** This miscellaneous area consists of moderately steep to very steep areas covered by stones. Stones larger than 10 inches in diameter cover more than 90 percent of the surface. This stone cover obscures significant soil features. The rock materials are commonly gray or red massive sandstone and gray sandstone conglomerate. The stones are several inches to several feet thick, and their edges have been subrounded by weathering. The areas are on mountaintops, ridges, and side slopes. They vary in shape and are about 5 to 500 acres in size.

Included in mapping are small areas of a shallow soil that has a sandy surface layer, Rock outcrops, rock escarpments, and nearly level to gently sloping areas.

Permeability is moderately rapid to rapid, and available water capacity is very low. Surface runoff is rapid.

This map unit is used exclusively for watershed protection and wildlife habitat. It is not suited to farming, wood-

land, and most nonfarm uses because of the surface stones.

This map unit is too stony and steep for cultivated crops and pasture. Removal of the numerous surface stones is impractical.

The potential for woodland is very poor. Surface stones interfere with harvesting and mechanical planting.

This miscellaneous area has serious limitations for most nonfarm uses because of numerous surface stones. It is best suited to watershed protection, wildlife habitat, or aesthetic uses. The capability subclass is VIII; woodland ordination symbol is not assigned.

#### **ThA—Thorndale silt loam, 0 to 3 percent slopes.**

This deep, nearly level, poorly drained soil is on upland flats and in drainageways. Slopes are smooth and concave and more than 100 feet long. Areas are oval to elongated in shape and 2 to 45 acres in size.

Typically, the surface layer is dark brown silt loam about 5 inches thick. The subsoil extends to a depth of 60 inches. It is grayish brown silt loam to a depth of 14 inches and mottled, gray and light gray silty clay loam below that. At a depth of 36 inches is a firm and brittle fragipan of mottled, reddish brown and pale brown silty clay loam.

Included with this soil in mapping are small areas of Clarksburg and Melvin Variant soils.

This soil has slow permeability and high available water capacity. Surface runoff is slow. This soil has a high water table within 6 inches of the surface for part of the year. The rooting depth is restricted by the fragipan and high water table. In unlimed areas, reaction is strongly acid to neutral in the surface layer and subsoil.

Most areas are used for pasture. A few areas are cultivated or used for homesites. The potential is very poor for cultivated crops. This soil is best suited to wildlife habitat and trees. It has limitations for most nonfarm uses because of the slow permeability and high water table.

This soil is not suited to cultivated crops. It is generally not possible or feasible to reduce the water table because of the expense involved and lack of suitable outlets.

During drier periods, this soil is suited to pasture. Overgrazing, grazing when wet, and maintaining key plant species are the chief concerns of management. Needed are proper stocking rates, rotation of pasture, deferment of grazing, and restricted grazing during wet periods. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a small acreage is wooded. Potential productivity is moderate. The rooting depth is restricted by the dense fragipan and high water table. Equipment is restricted during wet seasons. Machine planting is practical on the larger areas.

This soil has limitations for most nonfarm uses because of slow permeability and the high water table.

These are serious limitations for the onsite disposal of waste. The capability subclass is Vw; woodland ordination symbol is 4w.

**ThB—Thorndale silt loam, 3 to 8 percent slopes.**

This deep, gently sloping, poorly drained soil is on upland flats in drainageways. Slopes are smooth, concave, and more than 100 feet long. Areas are oval to elongated in shape and 2 to 30 acres in size.

Typically, the surface layer is dark brown silt loam about 5 inches thick. The subsoil extends to a depth of 60 inches. It is grayish brown silt loam to a depth of 14 inches. Below that is mottled gray and light gray silty clay loam to a depth of 36 inches. At a depth of 36 inches is a firm and brittle fragipan of mottled, reddish brown and pale brown silty clay loam.

Included with this soil in mapping are small areas of Clarksburg and Melvin Variant soils.

This soil has slow permeability and high available water capacity. Surface runoff is slow. This soil has a high water table within 6 inches of the surface for part of the year. The rooting depth is restricted by the fragipan and high water table. In unlimed areas, reaction is strongly acid to neutral in the surface layer and subsoil.

Most areas are pasture. A few areas are cultivated or used for homesites. The potential is very poor for cultivated crops. This soil is best suited to wildlife habitat and trees. It has limitations for most nonfarm uses because of slow permeability and high water table.

This soil is not suited to cultivated crops. It is generally not possible or feasible to drain the soil for cultivated crops because of the expense involved and lack of adequate outlets.

During drier periods, this soil is suited to pasture. Overgrazing, grazing when wet, and maintaining key plant species are major concerns of management. Needed are proper stocking rates, rotation of pasture, deferment of grazing and restricted grazing during wet periods. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a small acreage is wooded. Potential productivity is moderate. Equipment is restricted during wet seasons. Machine planting is practical on the larger areas.

There are limitations for most nonfarm uses because of slow permeability and the high water table. These are serious limitations for the onsite disposal of waste. The capability subclass is 6w; woodland ordination symbol is 4w.

**UnB—Ungers loam, 3 to 8 percent slopes.** This gently sloping, deep, well drained soil is on uplands. Slopes are smooth, convex, and 100 to 350 feet long. Areas are irregular in shape and about 2 to 45 acres in size.

Typically, the surface layer is dark brown loam about 9 inches thick. The subsoil extends to a depth of 40

inches. It is reddish brown loam to a depth of 11 inches and reddish brown sandy clay loam and gravelly sandy clay loam below that. The substratum to a depth of 60 inches is weak red channery sandy loam.

Included with this soil in mapping are small areas of Bucks and Penn soils. Also included are small wet areas.

This soil has moderate permeability and high available water capacity. Surface runoff is medium. In unlimed areas, reaction is extremely acid or very strongly acid throughout.

Most areas are cultivated. Small areas are used for homesites and trees. The potential is good for farming; this soil is well suited to pasture and trees. The potential for homesites is good. There are limitations for other nonfarm uses because of frost action and bedrock within 3-1/2 to 6 feet of the surface.

When this soil is cultivated, there is a moderate hazard of erosion. Crops respond well to fertilizer and good management. Minimum tillage, diversions, use of cover crops, and including grasses and legumes in the cropping system help reduce runoff and control erosion. Growing cover crops and utilizing crop residues are ways of maintaining the organic matter content.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pastures are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is well suited to trees, but only a small acreage is wooded. Potential productivity is moderate. Machine planting is practical on larger areas.

There are limitations for nonfarm uses because of the moderate frost action and areas where the bedrock is within 3-1/2 to 6 feet of the surface. Bedrock at a depth of less than 6 feet may interfere with deep excavation. The capability subclass is 1le; woodland ordination symbol is 4o.

**UnC—Ungers loam, 8 to 15 percent slopes.** This sloping, deep, well drained soil is on uplands. Slopes are smooth, convex, and 100 to 400 feet long. Areas are irregular in shape and about 2 to 75 acres in size.

Typically, the surface layer is dark brown loam about 9 inches thick. The subsoil extends to a depth of 48 inches. It is reddish brown loam, sandy clay loam, and gravelly sandy clay loam. The substratum to a depth of 60 inches is weak red channery sandy loam.

Included with this soil in mapping are small areas of Bucks and Penn soils and Ungers soils that have a gravelly loam surface layer.

This soil has moderate permeability and high available water capacity. Surface runoff is medium. In unlimed areas, reaction is extremely acid or very strongly acid throughout.

Most areas are cultivated. Small areas are used for homesites and trees. The potential is good for cultivated crops; this soil is well suited to pasture and trees. The

potential for homesites is good. There are limitations for other nonfarm uses because of frost action and bedrock within 3-1/2 to 6 feet of the surface.

When this soil is cultivated, there is a severe hazard of erosion. Crops respond well to fertilizer and good management. Minimum tillage, diversions, use of cover crops, and including grasses and legumes in the cropping system help reduce runoff and control erosion. Growing cover crops and utilizing crop residues are ways of maintaining the organic matter content.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pastures are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is well suited to trees, but only a small acreage is wooded. Potential productivity is moderate. Machine planting is practical on larger areas.

There are limitations for urban uses because of the moderate frost action and areas where the bedrock is within 3-1/2 to 6 feet of the surface. Bedrock at a depth of less than 6 feet may interfere with deep excavation. The capability subclass is IIIe; woodland ordination symbol is 4o.

**UnD—Ungers loam, 15 to 25 percent slopes.** This moderately steep, deep, well drained soil is on convex uplands. Slopes are smooth, convex, and 100 to 350 feet long. Areas are irregular in shape and about 2 to 60 acres in size.

Typically the surface layer is dark reddish brown loam about 9 inches thick. The subsoil extends to a depth of 40 inches. It is reddish brown sandy clay loam in the upper part to a depth of 24 inches and gravelly sandy clay loam below that. The substratum to a depth of 60 inches is weak red channery sandy loam.

Included with this soil in mapping are small areas of Penn soils; Ungers soils that have a gravelly loam surface; and small, scattered wet spots.

This soil has moderate permeability and high available water capacity. Surface runoff is rapid. In unlimed areas, reaction is extremely acid or very strongly acid throughout.

Most areas are in woodland. A few areas are used for homesites. The potential is limited for most cultivated crops because of slope. This soil is well suited to hay, pasture, and trees. Moderately steep slope is the major limitation for most nonfarm uses. Frost action and bedrock at depths of 3-1/2 to 6 feet may be problems for some uses.

When this soil is cultivated, there is a very severe hazard of erosion. Crops respond well to fertilizer and good management. Control of erosion and maintaining organic matter are chief concerns of management. Minimum tillage, strip cropping, diversions, sod waterways, use of cover crops, and including grasses and legumes in the cropping system help reduce runoff and control

erosion. Growing cover crops and utilizing crop residues are ways of maintaining organic matter.

When this soil is used for pasture, proper stocking rates to maintain key plant species and rotation of pastures are the chief management needs. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is well suited to trees. Potential productivity is moderate. Moderately steep slopes is a limitation in equipment selection and mechanical planting.

There are limitations for many nonfarm uses because of the slope, frost action, and bedrock at depths of 3-1/2 to 6 feet. The moderately steep slope is a serious limitation for onsite waste disposal, buildings, and roads. The capability subclass is IVe; woodland ordination symbol is 4r.

**UoB—Ungers extremely stony loam, 3 to 8 percent slopes.** This gently sloping, well drained soil is on lower side slopes and tops of ridges. Slopes are smooth, convex, and 200 to 700 feet long. The areas are irregular in shape and about 4 to 120 acres in size. Large stones cover about 15 to 50 percent of the surface.

Typically, the surface layer is dark brown loam about 3 inches thick. The subsoil extends to a depth of 40 inches. It is reddish brown loam to a depth of 11 inches. Below that is reddish brown sandy clay loam and gravelly sandy clay loam. The substratum to a depth of 60 inches is weak red channery sandy loam.

Included with this soil in mapping are small areas of sloping Ungers soils, Bucks and Penn soils, and scattered areas of very stony soils.

This soil has moderate permeability and high available water capacity. Surface runoff is medium. In unlimed areas, reaction is extremely acid or very strongly acid throughout.

Most areas are woodland. A few areas are used for homesites. The potential is poor for cultivated crops and pasture and limited for many nonfarm uses because of surface stones. Potential is good for trees and wildlife habitat.

This soil is too stony for cultivated crops and pasture. The surface stones are too numerous and large to be economically removed.

This soil is suited for trees. Potential productivity is moderate. Large surface stones interfere with harvesting and mechanical planting.

There is a serious limitation for many nonfarm uses because of the numerous surface stones. These stones are a serious limitation for onsite waste disposal. The capability subclass is VIIs; woodland ordination symbol is 4x.

**UoC—Ungers extremely stony loam, 8 to 25 percent slopes.** This sloping and moderately steep, well drained soil is on mid and upper side slopes of ridges. Slopes are smooth, convex, and 200 to 530 feet long.

Areas are irregular in shape and about 4 to 120 acres in size. Large stones cover about 15 to 50 percent of the surface.

Typically, the surface layer is dark brown loam about 3 inches thick. The subsoil extends to a depth of 40 inches. It is reddish brown loam to a depth of 11 inches. Below that is reddish brown sandy clay loam and gravelly sandy clay loam. The substratum to a depth of 60 inches is weak red channery sandy loam.

Included with this soil in mapping are small areas of gently sloping Ungers soils, Bucks and Penn soils, and scattered areas of very stony soils.

This soil has moderate permeability and high available water capacity. Surface runoff is medium. In unlimed areas, reaction is extremely acid or very strongly acid throughout.

Most areas are woodland. A few areas are used for homesites. The potential is very poor for cultivated crops and pasture and poor for many nonfarm uses. The potential is good for trees and wildlife habitat.

This soil is too stony for cultivated crops and pasture. Surface stones are too numerous and large to be economically removed.

This soil is suited to trees. Potential productivity is moderate. The surface stones interfere with harvesting and mechanical planting.

This soil is seriously limited for many nonfarm uses because of surface stones and slope. These are serious limitations for onsite disposal of waste. The capability subclass is VII<sub>s</sub>; woodland ordination symbol is 4x.

**UPE—Ungers and Calvin soils, steep.** These steep and very steep, deep and moderately deep, well drained soils are on side slopes of ridges. The composition of this map unit varies somewhat more than that of most other units in the county. Slopes are smooth, convex, and variable in length. Areas vary in shape and are about 4 to 402 acres in size. Individual areas may contain all Ungers soil, all Calvin soil, or any combination of the two. Large stones cover about 3 to 50 percent of the surface.

Typically, the Ungers soil has a surface layer of dark brown loam about 3 inches thick. The subsoil extends to a depth of 40 inches. It is reddish brown loam to a depth of 11 inches. Below that is reddish brown sandy clay loam and gravelly sandy clay loam. The substratum to a depth of 60 inches is weak red channery sandy loam.

Typically, the Calvin soil has a surface layer of dark reddish brown shaly silt loam about 6 inches thick. The subsoil extends to a depth of 27 inches. It is weak red very shaly light clay loam to a depth of 16 inches. Below that it is reddish brown very shaly light clay loam. The substratum is weak red very shaly loam to a depth of 40 inches. Weak red fractured shale bedrock is at a depth of 40 inches.

Included with this soil in mapping are areas of moderately steep Ungers and Calvin soils, Penn and Laidig

soils, and Rock outcrop. The inclusions range from 5 to 25 acres in size and may make up about 15 to 35 percent of an individual delineation. About 50 percent of this undifferentiated unit is Ungers soils, about 25 percent is Calvin soils, and the rest is inclusions.

Permeability is moderate in Ungers soils and moderately rapid in Calvin soils. The available water capacity is high in Ungers soil and low in Calvin soils. Surface runoff is rapid.

These soils are mostly wooded. The potential is poor for cultivated crops and pasture because of the numerous surface stones and steepness of slope.

These soils are suited to trees and have moderate to high productivity potential. The surface stones and steepness of slope are serious limitations for harvesting and machine planting. Erosion control practices may be needed in areas disturbed during harvesting.

There are serious limitations for most nonfarm uses. The numerous surface stones and steepness of slope are serious limitations for homesite and onsite waste disposal. There is some potential for open space and recreation. The capability subclass is VII<sub>s</sub>; woodland ordination symbol for Ungers part is 4r and for Calvin part is 2f.

**UR—Urban land-Berks complex.** This complex is nearly level to moderately steep and is on side slopes within dissected uplands. The composition of this map unit varies somewhat more than that of most other units in the county. Slopes are complex and 75 to 350 feet in length. The areas are irregular in shape and about 30 to 530 acres in size.

This complex consists of land used for houses, schools, factories, shopping centers, hospitals, roads, and other urban developments. Soils have been cut and filled, mixed, and covered over to an extent that separation of soils is impractical at the scale of the soil map.

Undisturbed areas are Berks soils. Sixty-five percent of this unit is Urban land, and about 20 percent is Berks soils. The rest is soils that formed in material similar to the Berks soils. Most of this unit is within the Edward Martin Military Reservation. Other areas are within the boroughs in the northern part of the county.

In the Urban land part of the complex the soils are so mixed that no profile can be described as typical. In the Berks part, typically, the surface layer is dark brown shaly silt loam about 9 inches thick. This subsoil extends to a depth of 28 inches. It is strong brown shaly silt loam to a depth of 15 inches. Below that it is strong brown, very shaly silt loam. The substratum to a depth of 33 inches is yellowish brown very shaly silt loam. Bedrock is at a depth of 33 inches.

Included in mapping are soils formed in parent material similar to that of the Berks soils but shallower or deeper to bedrock, soils that are not well drained, soils that are subject to flooding, and areas of rock outcrops. Included areas range from 3 to 25 acres in size and may



make up as much as 35 percent of an individual delineation.

Onsite investigation is needed to determine hazards, limitations, and suitability for use of the individual areas. The capability subclass is not assigned; woodland ordination symbol for Urban land is not assigned, but for the Berks part is 3f.

**US—Urban land-Hagerstown complex.** This nearly level to moderately steep complex is within the limestone valley. The composition of this map unit varies somewhat more than that of most other units in the county. Slopes are complex and 150 to 1,200 feet in length. The areas are irregular in shape and about 30 to 1,550 acres in size.

This complex is used for houses, schools, factories, shopping centers, hospitals, other urban developments, and woods. The soils have been cut and filled, mixed, and mostly covered with asphalt or concrete to an extent that separation of soils is impossible at the scale of the soil map. Undisturbed areas are Hagerstown soils. This unit is 65 percent Urban land and about 20 percent Hagerstown soils. Most of this unit is within the city of Lebanon. Other areas are within the boroughs in the southern part of the county.

In the Urban land part of the complex the soils are so mixed that no profile can be described as typical. In the Hagerstown part, typically, the surface layer is dark yellowish brown silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches. It is strong brown silty clay loam to a depth of 13 inches. Below that it is yellowish red and strong brown silty clay and silty clay loam.

Included in mapping are soils formed in parent material similar to that of the Hagerstown soils but that have less clay and a yellower subsoil. Also included are wetter soils, soils that are subject to flooding, and areas of rock outcrops. Included areas range from 3 to 25 acres in size and may make up as much as 35 percent of an individual delineation.

Onsite investigations are needed to determine hazards, limitations, and suitability for use of the individual areas. The capability subclass is not assigned; woodland ordination symbol for Urban land is not assigned, but for the Hagerstown part is 1x.

**WaA—Watchung silt loam, 0 to 5 percent slopes.** This nearly level and gently sloping, deep, poorly drained soil is on foot slopes and in depressional areas. Slopes are smooth and nearly flat to convex and 100 to 600 feet in length. Areas are irregular in shape and about 4 to 80 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil extends to a depth of 35 inches. It is mottled, gray silt loam, silty clay, and clay. The substratum to a depth of 50 inches is

yellowish brown silty clay. Below that to a depth of 62 inches is mottled, strong brown silt loam.

Included with this soil in mapping are small areas of gently sloping Mount Lucas soils.

This soil has slow permeability and high available water capacity. Surface runoff is slow. The high water table is within 6 inches of the surface for part of the year. In unlimed areas reaction is medium acid to neutral in the subsoil and substratum.

Most areas are pasture. Other areas are wooded or used for homesites. The potential is poor for cultivated crops and pasture. This soil is fairly suited to wildlife habitat or trees. The potential is poor for homesites and most other nonfarm uses because of the slow permeability and high water table. This soil is not suited to cultivated crops and pasture because of the high water table. It is not generally feasible to lower the water table for cultivated crops or pasture because of the expense involved.

This soil is fairly suited to trees, but only a small acreage is wooded. Potential productivity is very high for moisture-tolerant trees. The rooting depth is restricted by the seasonal high water table. Removal of undesirable species will help increase production. Use of equipment is restricted during wet seasons because of the high water table.

There are serious limitations for most nonfarm uses because of the high water table and slow permeability. These are serious limitations for the onsite disposal of waste. The capability subclass is VIw; woodland ordination symbol is 1w.

**WbB—Watchung extremely stony silt loam, 0 to 8 percent slopes.** This nearly level and gently sloping, deep, poorly drained soil is in broad upland depressions and on foot slopes. Slopes are 100 to 600 feet in length. The areas are irregular in shape and about 5 to 20 acres in size. Large stones cover about 15 to 50 percent of the surface.

Typically, in a wooded area, this soil has 3 inches of leaf litter and organic mat over a dark gray silt loam surface layer that is about 6 inches thick. The subsurface layer is dark gray silt loam about 5 inches thick. The subsoil extends to a depth of 35 inches. It is gray mottled silty clay and clay. The substratum extends to a depth of 62 inches or more. It is yellowish brown silty clay to a depth of 50 inches and mottled strong brown silt loam below that.

Included with this soil in mapping are small areas of Watchung silt loam and extremely stony Mount Lucas soils.

This soil has slow permeability and high available water capacity. Surface runoff is slow. In unlimed areas, reaction is medium acid to neutral in the subsoil and substratum. The high water table is within 6 inches of the surface most of the year. The rooting depth is restricted by the high water table.



Most areas are woodland. A few areas are used for homesites. The potential is very poor for cultivated crops, pasture, and most nonfarm uses. This soil is better suited to moisture-tolerant trees and wildlife habitat. The potential is poor for homesites because of the surface stones and high water table.

The soil is not suited to cultivated crops and pasture because of numerous surface stones and high water table. It is not usually feasible to remove the surface stones and lower the water table because of the expense involved.

This soil is fairly suited to moisture-tolerant trees, and most acreage is wooded. Potential productivity is very high, but the rooting depth is restricted by the high water table. Removal of undesirable species will help increase production. Use of equipment is restricted because of the numerous surface stones and high water table. The large surface stones interfere with harvesting and seeding.

There are limitations for most nonfarm uses because of the high water table, slow permeability, and extremely stony surface. These limitations are serious for homesites and onsite waste disposal. The capability subclass is VIIc; woodland ordination symbol is 1x.

**WeB—Weikert shaly silt loam, 3 to 8 percent slopes.** This gently sloping, shallow, well drained soil is on tops of convex, dissected ridges and hills. Slopes are convex and 75 to 600 feet in length. Areas are oval to irregular in shape and about 2 to 60 acres in size.

Typically, the surface layer is dark brown shaly silt loam about 9 inches thick. The subsoil extends to a depth of 14 inches. It is dark yellowish brown very shaly silt loam to a depth of 23 inches. The substratum to a depth of 17 inches is yellowish brown very shaly silt loam. Gray fractured shale bedrock is at a depth of 17 inches.

Included with this soil in mapping are a few areas of Klinesville soils, Berks soils, and nearly level Weikert soils.

This soil has moderately rapid permeability and very low available water capacity. Surface runoff is rapid. The root zone is restricted by shallow depth to bedrock. Very low available water capacity retards plant growth. In unlimed areas, reaction is medium acid to very strongly acid.

Most areas are cultivated. Small areas are used for homesites and trees. The potential is fair for cultivated crops, pasture, and trees. The potential for homesites is fair, but the shallow depth to bedrock is a limitation for most other nonfarm uses.

When this soil is cultivated, there is a moderate erosion hazard. Further erosion would result in a shallower rooting depth and lower available water capacity. Reducing erosion and maintaining available water capacity and organic matter content are chief concerns of management. Minimum tillage, use of cover crops, and including

grasses and legumes in the cropping system help reduce runoff and control erosion. Incorporating manure and crop residue into the surface layer will help maintain organic matter content.

When this soil is used for pasture, maintaining key plant species and preventing overgrazing are chief management needs. Proper stocking rates, rotation of pasture, deferment of grazing and restricted grazing during dry periods will help maintain key plant species and prevent overgrazing. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a small acreage is wooded. Potential productivity is moderate. Equipment limitation, windthrow hazard, and severe seedling mortality are management problems. Machine planting is practical on the larger areas.

There are limitations for most nonfarm uses because of the shallow depth to bedrock, shaly surface layer, and moderately rapid permeability. Bedrock at a shallow depth is a serious limitation for onsite disposal of waste. Excavating for buildings may also be a problem (fig. 10). When this soil is disturbed for construction, it is necessary to control erosion and sediment. The capability subclass is IIIc; woodland ordination symbol is 4d.

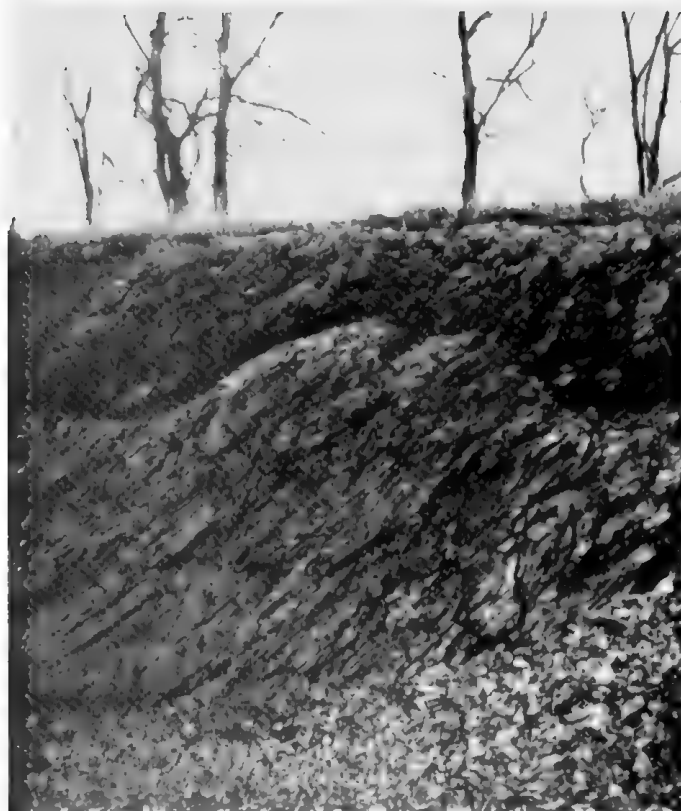


Figure 10.—Shallow depth to shale bedrock under Weikert shaly silt loam, 3 to 8 percent slopes, limits many uses. The uplift is typical.

**WeC—Weikert shaly silt loam, 8 to 15 percent slopes.** This sloping, shallow, well drained soil is on upper side slopes of convex, dissected ridges and hills. Slopes are convex and 75 to 500 feet in length. Areas are oval to irregular in shape and about 2 to 80 acres in size.

Typically, the surface layer is dark brown shaly silt loam about 9 inches thick. The subsoil extends to a depth of 14 inches. It is dark yellowish brown very shaly silt loam. The substratum to a depth of 17 inches is yellowish brown very shaly silt loam. Gray shale bedrock is at a depth of 17 inches.

Included with this soil in mapping are a few areas of Klinesville and Berks soils and steeper Weikert soils. Also included are small spring seeps.

This soil has moderately rapid permeability and very low available water capacity. Surface runoff is rapid. The root zone is restricted by the shallow depth to bedrock. Plant growth is retarded by very low available water capacity. In unlimed areas, reaction is medium acid to very strongly acid.

Most areas are cultivated. Small areas are used for homesites and trees. The potential is fair for farming. Potential for grasses and trees is also fair. The potential for homesites is fair, but the shallow depth to bedrock is a limitation for most other nonfarm uses.

When this soil is cultivated, there is a moderate erosion hazard. Further erosion would result in a shallower rooting depth and lower available water capacity. Erosion control and maintaining available water content and organic matter are chief concerns of management. Minimum tillage, stripcropping, use of cover crops, and including grasses and legumes in the cropping system will help reduce runoff and control erosion. Incorporating manure and crop residue into the surface layer will help maintain the organic matter content.

When this soil is used for pasture, maintaining key plant species and preventing overgrazing are chief concerns of pasture management. Proper stocking rates, rotation of pasture, deferment of grazing, and restricted grazing during dry periods will help maintain key plant species and prevent overgrazing. Optimum production requires maintenance of fertility through periodic applications of nutrients.

This soil is suited to trees, but only a small acreage is wooded. Potential productivity is moderate. Equipment limitation, windthrow hazard, and seedling mortality are concerns of management. Machine planting is practical on the larger areas.

This soil is limited for many nonfarm uses because of the shallow depth to bedrock, shaly surface layer, slope, and moderately rapid permeability. Shallow depth is a serious limitation for onsite disposal of waste. Excavating for buildings may also be a problem. When this soil is disturbed for construction, it is necessary to control erosion and sediment. The capability subclass is IVe; woodland ordination symbol is 4d.

**WeD—Weikert shaly silt loam, 15 to 25 percent slopes.** This moderately steep, shallow, well drained soil is on convex side slopes of dissected ridges and hills. Slopes are convex and 75 to 500 feet in length. Areas are about 4 to 150 acres in size.

Typically, the surface layer is dark brown shaly silt loam about 9 inches thick. The subsoil to a depth of 14 inches is dark yellowish brown very shaly silt loam. The substratum to a depth of 17 inches is yellowish brown very shaly silt loam. Gray shale bedrock is at a depth of 17 inches.

Included with this soil in mapping are a few areas of Klinesville, Berks, and Weikert soils that have a very shaly surface and sloping and steep Weikert soils.

This soil has moderately rapid permeability and very low available water capacity. Surface runoff is rapid to very rapid. The root zone is restricted by shallow depth to bedrock. Plant growth is retarded by very low available water. In unlimed areas, reaction is medium acid to very strongly acid throughout.

Most areas are cultivated. Small areas are used for homesites and trees. The potential is poor for farming. The potential for trees is fair. The potential is poor for most nonfarm uses because of moderately steep slope and depth to bedrock.

This soil is poorly suited to cultivated crops, hay, or pasture because of moderately steep slope and very low available water capacity.

This soil is suited to trees, but only a small acreage is wooded. Potential productivity is moderate. Equipment limitations, windthrow hazard, and seedling mortality are chief concerns of management.

There are limitations for most nonfarm uses because of moderately steep slope, shallow depth to bedrock, and a shaly surface layer. The moderately steep slope and shallow depth to bedrock are serious limitations for onsite waste disposal. Excavating for buildings is also a problem. When this soil is disturbed for construction, it is necessary to control erosion and sediment. The capability subclass is VIe; woodland ordination symbol is 4d.

**WeE—Weikert shaly silt loam, 25 to 50 percent slopes.** This steep and very steep, shallow, well drained soil is on steeper side slopes of dissected ridges. Slopes are convex and 100 to 600 feet in length. Areas are about 10 to more than 200 acres in size.

Typically, the surface layer is dark brown shaly silt loam about 4 inches thick. The subsoil to a depth of 9 inches is dark yellowish brown very shaly silt loam. The substratum to a depth of 12 inches is yellowish brown very shaly silt loam. Gray shale bedrock is at a depth of 12 inches.

Included with this soil in mapping are a few areas of Klinesville, Berks, and Weikert soils that have a very stony and very shaly surface layer and moderately steep Weikert soils. Also included is Rock outcrop.

This soil has moderately rapid permeability and very low available water capacity. Surface runoff is rapid to very rapid. The rooting depth is restricted by the shallow depth to bedrock. Plant growth is retarded by very low available water capacity. In unlimed areas, reaction is medium acid to very strongly acid throughout.

Most areas are wooded. The potential is poor for farming and fair for trees. Potential is poor for most nonfarm uses because of steep and very steep slope and depth to bedrock.

This soil is not suited to cultivated crops, hay, or pasture because of steep and very steep slope and very low available water.

This soil is fairly suited to trees, and most acreage is wooded. Potential productivity is moderate. Serious equipment limitation, windthrow hazard, and seedling mortality are the chief concerns of management.

This soil has serious limitations for most nonfarm uses because of steep and very steep slope and shallow depth to bedrock. There is potential for open space and wildlife habitat. The capability subclass is VIIe; woodland ordination symbol is 4d.

## Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productiv-

ity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

## Crops and pasture

John C. Spitzer, conservation agronomist, Soil Conservation Service, helped prepare this section.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

More than 125,000 acres in Lebanon County was used for crops and pasture in 1967, according to the Conservation Needs Inventory. Of this total, 29,172 acres was used for permanent pasture; 34,221 acres for row crops, mainly corn; 20,383 acres for close-grown crops, mainly wheat and oats; 20,180 acres for rotation hay and pasture; 8,789 acres for permanent hayland; 935 acres for orchard; and the rest for conservation use only or idle cropland.

The potential is good for increased production of food. About 4,071 acres of soils that have good potential for cropland is currently used as woodland, and about 11,781 acres is used as pastureland. In addition, food production could be increased considerably on the existing cropland by using modern crop production technology.

Soil erosion is the major management problem on most cropland and pasture in Lebanon County. It also may result in sediment deposition in streams and reservoirs, pollution of streams, and reduced water quality for all uses.

Bucks, Bedington, Chester, Duffield, Hagerstown, Murrill, and Neshaminy soils are among the most productive soils in the county, but are highly susceptible to erosion. On these and other soils, good conservation practices should be used to reduce the hazard of erosion and to increase production.

Loss of the surface layer through erosion causes reduced production. This is especially true of soils that are shallow or moderately deep over bedrock, soils that have a fragipan, and soils that have a low available water capacity. Klinesville, Weikert, Berks, and Penn are shallow and moderately deep soils that have a low available water capacity. Buchanan, Clarksburg, Comly, and Laidig are among the soils that have a fragipan.

Good conservation and erosion control practices provide protective cover, reduce surface runoff and sedimentation, and increase infiltration. Cropping systems that maintain vegetative cover add to the productivity of the soils. On pasture and hayland, deferred grazing, proper grazing, and the use of grasses and legumes help to reduce erosion, provide nitrogen, and improve tilth. Contour farming, terraces, minimum tillage, cover crops, and leaving crop residues on the soil help to increase infiltration and reduce erosion hazards. These practices are suitable for most soils.

Terraces and diversions shorten the slope, which reduces surface runoff and erosion. They are most practical on deep, well drained soils of moderate and uniform slope. Chester, Neshaminy, Laidig, Bedington, Leck Kill, and Ungers soils are generally suitable for terraces and diversions. Other soils are less suitable because of steep or irregular slope, excessive wetness, clayey subsoil, or shallow depth to bedrock.

Contour farming and strip cropping are commonly used to control erosion in the survey area. They are best suited to soils of uniform slope, such as Berks, Chester, Duffield, Hagerstown, Laidig, Murrill, and Ungers soils.

Information or assistance regarding methods of erosion control is available from the Lebanon Conservation District and the Lebanon Field Office of the Soil Conservation Service.

Drainage is a major management problem on many of the soils. Some soils are so wet that crop production is not practical or economically feasible without artificial drainage. These include the poorly drained Brinkerton, Markes, Thorndale, and Watchung soils, which total approximately 7,915 acres in the county.

The somewhat poorly drained soils are so wet that crop damage results during most years unless artificial drainage is applied. In this category are Abbottstown and, in some areas, Comly soils. These soils total approximately 6,335 acres.

Some small wet areas are in drainageways and swales. These areas are generally inclusions within the moderately well drained Clarksburg and Lehigh soils. Artificial drainage could improve the management and productivity of most of these areas, but this may not be economically feasible.

The design of both surface and subsurface drainage systems varies according to the soil. A combination of surface drainage and tile drainage is usually needed for those poorly drained soils that are intensively cropped. Drains must be more closely spaced in the soils that have slow permeability than in those that are more permeable. In addition, adequate outlets for tile drainage systems are often difficult to locate. Thorndale, Holly, and Markes are examples of soils that have these problems.

Natural fertility is low in many soils in the survey area. Natural reaction in many soils in the uplands is strongly acid. These soils require applications of ground limestone to supply calcium and to raise the pH sufficiently for good growth of alfalfa and other crops. Natural levels of available phosphorus and magnesium are low in most soils. The addition of soil amendments should be based on soil tests, requirements of the crop, and expected or desired yields. The local office of the Cooperative Extension Service can help determine the kinds and amounts of fertilizer and lime to apply.

Soil tilth is an important factor in seed germination, plant growth, and infiltration of water. Soils in good tilth are granular and porous, such as the Bedington, Brecknock, Chester, and Neshaminy soils.

Many soils used for crop production in the survey area have a relatively low level of organic matter. Generally, the structure of such soils is weak, and heavy rainfall usually results in crusting of the surface. The crust is commonly hard and nearly impervious to water when dry. Such a crust usually reduces infiltration and increases runoff. Regular additions of crop residue, manure, and other organic material can help to improve soil structure and reduce crust formation.

Generally, fall plowing is not a good practice on light-colored soils that have a silt loam surface layer. It commonly results in the formation of a crust during winter and spring. Many soils are nearly as dense and hard at planting time after fall plowing as they were before they were plowed. In addition, soils are subject to increased erosion if they are plowed in the fall.

Corn is the major row crop, although grain sorghum, potatoes, tobacco, and soybeans are grown when economic conditions are favorable. Wheat, oats, and barley are the common close-growing crops. The deep, well drained soils have the best potential for crops. However, many other soils will also produce good yields, under adequate management.

Special commercial crops produced in the survey area are apples, peaches, grapes, vegetables, and nursery plants. Soils that are deep, have good natural drainage,

and warm up early in spring are best suited to special crops such as the tree fruits. Good air drainage is needed to reduce frost damage to apple and peach trees. Duffield, Hagerstown, Bedington, and Bucks soils have the best properties for tree fruits.

Latest information and suggestions for growing special crops can be obtained from the local offices of the Soil Conservation Service and the Cooperative Extension Service.

### Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 4. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the soil is not suited to the crop or the crop is not commonly grown on the soil or that a given crop is not commonly irrigated.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 4.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the productive capacity of the soils for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 4 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

### Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

*Capability classes*, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and landforms have limitations that nearly preclude their use for commercial crop production.

*Capability subclasses* are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is indicated in table 5. Some of the soils that are well suited to crops and pasture may be in low-intensity use, for example, soils in capability classes I and II. Data in this table can be used to determine the farming potential of such soils.

The capability subclass is identified in the description of each soil map unit in the section "Soil maps for detailed planning."

## Woodland management and productivity

Paxton G. Wolfe, woodland conservationist, Soil Conservation Service, helped prepare this section.

Lebanon County has approximately 70,900 acres of woodland (9). This is nearly 31 percent of the total land area of the county. Farmers own 20 percent, other private concerns 42 percent, and the Pennsylvania Game Commission 38 percent of the commercial woodland in the county. Thirteen percent of the woodland is classified non-commercial.

Stands of second and third growth trees make up the woodland. The principal forest cover types (7) and the extent of each, according to the Forest Service, are as follows:

Oak-hickory forest type makes up 82 percent of the total woodland. This type mainly consists of white oak, red oak, and hickories, although black oak and chestnut oak are sometimes predominant. The principal associates are yellow-poplar, shagbark hickory, white ash, red maple, and beech.

Elm-ash-red maple forest type makes up 8 percent. White ash, American elm, and red maple are the main species. Associates are slippery elm, yellow birch, sycamore, and hemlock.

Maple-beech-birch forest type is 7 percent. Sugar maple, beech, and yellow birch are the main species. Associated species are varying admixtures of basswood, red maple, hemlock, red oak, white ash, white pine, black birch, black cherry, yellow-poplar, and cucumber-tree.

Aspen-birch forest type makes up 1 percent. Quaking aspen, bigtooth aspen, and gray birch are dominant. Principal associates are pin cherry, red maple, yellow birch, white pine, ash, and sugar maple.

Chestnut oak forest type makes up another 1 percent. Chestnut oak grows in pure stands or is dominant. Common associates are red oak, white oak, black oak, scarlet oak, pitch pine, blackgum, and red maple.

Virginia pine-pitch forest type makes up the remaining 1 percent. Virginia pine and pitch pine are dominant. Principal associates are red oak, black oak, scarlet oak, chestnut oak, and hickory.

Eighty-eight percent of the woodland areas in the county are rated excellent, very good, or good as woodland sites. Eleven percent is rated fair, and 1 percent is poor.

Sawtimber makes up approximately 73 percent of the commercial forest, poletimber 21 percent, and seedlings and saplings 4 percent. The remaining 2 percent is classified as nonstocked or forest land that is less than 10 percent stocked with desirable trees.

In general, the soils in the county are capable of supporting good stands of red oak, yellow-poplar, ash, and white pine. Trees grow more slowly on the shallow and poorly drained soils than on the deeper, well drained soils. Management problems include erosion, equipment limitation, seedling mortality, plant competition, and windthrow hazard.

Desirable species can be encouraged by using good woodland management in areas where the soils are rated very high, high, or moderately high for potential productivity. The Forest Service or a consulting forester can provide assistance in developing a woodland improvement program. Such management is generally not economically feasible, however, on soils rated low in potential productivity.

Soils rated moderate are the most difficult to appraise for management of wood crops. A thorough onsite inventory is needed of the growing stock and its quality. The market potential of these species and whether or not areas of more productive soils are included in the site must be investigated to determine if woodland management is justified.

The woodland in Lebanon County provides watershed protection, recreation and esthetic values, as well as a source of income for woodland owners. The better sites will return a good profit to the owner if properly managed and protected from fire, disease, insects, and livestock grazing.

Table 6 contains information useful to woodland owners or forest managers planning use of the soils for wood crops. Only those soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in



the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: *x*, *w*, *t*, *d*, *c*, *s*, *f*, and *r*.

In table 6 the soils are also rated for a number of factors to be considered in management. *Slight*, *moderate*, and *severe* are used to indicate the degree of major soil limitations.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if some measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

*Seedling mortality* ratings indicate the degree that the soil affects expected mortality of planted tree seedlings. Plant competition is not considered in the ratings. Seedlings from good planting stock that are properly planted during a period of sufficient rainfall are rated. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Considered in the ratings of *windthrow hazard* are characteristics of the soil that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees in wooded areas are not expected to be blown down by commonly occurring winds; *moderate*, that some trees are blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in 50 years. The site index applies to fully stocked, even-aged, unmanaged stands.

*Trees to plant* are those that are suitable for commercial wood production and that are suited to the soils.

## Engineering

Lloyd Thomas, assistant state conservation engineer, Soil Conservation Service, assisted in preparing this section.

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational areas; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations



can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

*Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.*

The information is presented mainly in tables. Table 7 shows, for each kind of soil, the degree and kind of limitations for building site development; table 8, for sanitary facilities; and table 10, for water management. Table 9 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

### **Building site development**

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 7. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

*Shallow excavations* are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings

do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

*Dwellings and small commercial buildings* referred to in table 7 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

*Local roads and streets* referred to in table 7 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

*Lawns and landscaping* require soils that are suitable for the establishment and maintenance of turf for lawns and ornamental trees and shrubs for landscaping. The best soils are firm after rains, are not dusty when dry, and absorb water readily and hold sufficient moisture for plant growth. The surface layer should be free of stones. If shaping is required, the soils should be thick enough over bedrock or hardpan to allow for necessary grading. In rating the soils, the availability of water for sprinkling is assumed.

### Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 8 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and, if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, and *poor*, which mean about the same as the terms *slight*, *moderate*, and *severe*.

*Septic tank absorption fields* are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

*Sewage lagoons* are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

*Sanitary landfill* is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench-type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 8 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

*Daily cover for landfill* should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

If it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the

borrow areas. These factors include slope, erodibility, and potential for plant growth.

### Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 9 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

*Roadfill* is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 13 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low frost action potential, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

*Sand* and *gravel* are used in great quantities in many kinds of construction. The ratings in table 9 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 13.

*Topsoil* is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can restrict plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils or very firm clayey soils; soils that have suitable layers less than 8 inches thick; soils that have large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

### Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 10 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

*Pond reservoir areas* hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

*Embankments, dikes, and levees* require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organ-

ic matter in a soil downgrade the suitability of the soil for use in embankments, dikes, and levees.

*Aquifer-fed excavated ponds* are bodies of water made by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 10 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

*Drainage* of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

*Terraces and diversions* are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

*Grassed waterways* are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

## Recreation

There are many diversified recreational facilities in Lebanon County. These are used mainly by local residents. They also attract many visitors and provide an additional source of revenue for the county.

Among the major attractions are the large areas of State gamelands, two golf courses, Middle Creek Waterfowl Management Area, and competitive horse shows. Other activities include swimming, fishing, camping, horseback riding, flying, boating, bowling, tennis, hiking, and biking.

About 10 percent of the land is used for recreation. The largest recreational areas are the 20,723 acres of State gamelands. Most of the soils in the county have potential for some type of recreational development. The nearly level and gently sloping, deep, well drained soils that have few or no surface stones have the best potential for most recreational uses. Soils that have an extremely stony surface, Rock outcrop, and steep soils have serious limitations for most recreational uses. However, they have potential for hiking, hunting, and other types of recreation that require only slight land alteration. The soils that have the poorest potential for recreation

are the poorly and very poorly drained soils and the very steep soils.

The soils of the survey area are rated in table 11 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 11 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 8, and interpretations for dwellings without basements and for local roads and streets, given in table 7.

*Camp areas* require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

*Picnic areas* are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost of shaping sites or of building access roads and parking areas.

*Playgrounds* require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains,

and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

*Paths and trails* for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

*Golf fairways* are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They should have a surface that is free of stones and boulders and have moderate slopes. Suitability of the soil for traps, tees, or greens was not considered in rating the soils. Irrigation is an assumed management practice.

## Wildlife habitat

C. L. Strouphar, waterflow management assistant, Middle Creek Waterfowl Management Area, Pennsylvania Game Commission, helped prepare this section.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 12, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limita-

tions are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of habitat are very severe and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

The elements of wildlife habitat are briefly described in the following paragraphs.

*Grain and seed crops* are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

*Grasses and legumes* are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, brome grass, clover, and alfalfa.

*Wild herbaceous plants* are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

*Hardwood trees* and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of hardwood plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

*Coniferous plants* are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

*Wetland plants* are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive

of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, and rushes, sedges, and reeds.

*Shallow water areas* are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

*Openland habitat* consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants.

*Woodland habitat* consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants.

*Wetland habitat* consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow.

All the soils in Lebanon County provide habitats suitable for some species of wildlife. Deer, rabbits, raccoon, woodchucks, opossum, skunks, and fox can be found throughout the county.

White-tailed deer are considered a woodland species, but they neither prefer nor do well in large mature forests. They thrive where there is a combination of brush and young trees, fewer mature trees, and small open areas of grasses and herbs. The distribution and abundance of white-tailed deer are closely related to land use. Land use, in turn, is closely related to soil patterns.

Concentrations of white-tailed deer are in the northern and southern parts of the county along Little, Blue, Second, Sharp, and South Mountains. These areas have narrow farmed valleys between the mountains. Deer use the forest cover during the day and move onto the farms in the evening and night to feed. The deer also eat the young trees, shrubs, and forbs under the high power lines that cross these mountains.

Within the past few years, the largest populations of deer have been found within the Ungers-Neshaminy-Watchung, Chester-Murrill-Hazleton, and Bucks-Penn-Bowmansville general soil map units. The mature woodland and areas of intensive farming in these units provide an ideal habitat for deer.

Ruffed grouse are limited to the mountainous areas. The largest populations are in the the South Mountain area.

Pheasants are found on the Hagerstown-Duffield-Clarksburg map unit in the Lebanon Valley, which is the most intensively cultivated part of the county.

Cottontail rabbits are abundant throughout the county, and their number appears to be increasing. Although their distribution seems to be unrelated to soils, the largest populations are associated with the better farming areas in the Hagerstown-Duffield-Clarksburg, Bucks-Penn-Bowmansville, and Chester-Murrill-Hazleton map units.

Muskrat and mink can be found along most waterways and farm ponds, especially in the mountains of the northern part of the county in the Laidig-Hazleton-Leck Kill unit.

Beaver have been established in the Second Mountain area near Saint Joseph Springs and in the Sharp Mountain area near Rattling Run. This area is in the Laidig-Hazleton-Leck Kill unit.

Gray and fox squirrels are plentiful where woodlots produce good crops of mast. These woodlots are mainly in the Ungers-Neshaminy-Watchung and Laidig-Hazleton-Leck Kill units.

Mourning doves are scattered throughout the county. Plantations of introduced Scotch pine and Norway spruce, as well as the native eastern redcedar throughout the county, furnish roosting cover while adjacent farmlands provide food. Although the distribution of mourning doves seems unrelated to soils, the largest populations are associated with the better farming areas in the Hagerstown-Duffield-Clarksburg and Berks-Weikert-Bedington units.

Numerous species of waterfowl nest and breed in the Middle Creek Wildlife Management Area near Kleinfeltersville. This area is located in the Ungers-Neshaminy-Watchung unit.

## Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.



Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

## Engineering properties

Table 13 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 13 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

*Texture* is described in table 13 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (2) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (1).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated classification, without group index numbers, is given in table 13. Also in table 13 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

*Liquid limit* and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

## Physical and chemical properties

Table 14 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

*Permeability* is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of



water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

*Available water capacity* is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems. It is expressed as inches of water per inch of soil.

*Soil reaction* is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

*Shrink-swell potential* depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

*Risk of corrosion* pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

*Erosion factors* are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to

erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

## Soil and water features

Table 15 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

*Hydrologic soil groups* are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

*Flooding* is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons

that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

*High water table* is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

*Depth to bedrock* is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

*Potential frost action* refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well

drained very gravelly or sandy soils are the least susceptible.

## Formation of the soils

This section describes the factors and processes of soil formation in Lebanon County. It also explains the nomenclature of the major soil horizons.

### Factors of soil formation

Soils are complex mixtures of weathered rocks, minerals, organic matter, water, and air. They formed through the chemical and physical weathering of geologic materials. The extent of the weathering and the characteristics of the soil that develops depend on the nature of the parent material; the kind of climate; the relief, or lay of the land; the plant and animal life in and on the soil; and the length of time that these factors have affected development.

In a relatively small area such as Lebanon County, where most of these factors vary only slightly, the nature of the parent material produces most of the differences in soil texture and mineral content. Climate influences the nature and extent of the weathering processes. Relief affects drainage, aeration, runoff, erosion, and exposure to sun and wind. Plant and animal life influence soil characteristics by both physical and chemical removals and additions. Finally, time is required for the other soil-forming factors to exert their influence. Long periods are necessary for changes in soils to become apparent. Nevertheless, soils are slowly but constantly changing.

### Parent material

The soils of Lebanon County formed mainly in material weathered from shale, siltstone, sandstone, quartzite, and limestone. Duffield and Hagerstown soils formed in material weathered from limestone; Weikert, Berks, and Bedington soils formed in material weathered from acid sandstone, siltstone, and shale.

Ungers, Laidig, and Neshaminy soils formed in material weathered from acid sandstone, conglomerate, and diabase. The Ungers soils, derived from fine-grained sandstone, have a high content of sand. The reddish Leck Kill soils formed in material weathered from red shale and sandstone. Philo, Holly, Melvin Variant, and Pope soils formed in sediments deposited on flood plains of streams. In table 16, all soil series in the county are arranged by parent material, position, and drainage class.

### Climate

The climate of this county is the humid-temperate, continental type characteristic of the Middle Atlantic States. Some soil characteristics indicate that this kind of

climate prevailed when the soils were forming. Many of the soils are acid and strongly leached.

The effect of climate has been nearly uniform throughout the county. The formation of some soils, however, may have been influenced by a microclimate caused by differences in relief.

### **Relief**

Relief depends to a large extent on the nature of the underlying rock. The highest ridges in the landscape, such as those occupied by the Ungers and Leck Kill soils, are where the rocks are most resistant to weathering. Relief affects runoff, and runoff, in turn, affects the soils over which it flows. Runoff then enters streams that erode and dissect areas of soils. In areas of sloping or hilly relief, runoff and gravity cause soil material to move from side slopes and to accumulate at the base of slopes. Such accumulated material is an important part of the material in which the Laidig, Brinkerton, and Buchanan soils formed.

### **Plants and animals**

Hardwood trees have apparently had more effect on the formation of the soils of Lebanon County than other kinds of plants. Forests of hardwoods at one time covered most of the county. The forests were mainly of the oak-hickory type, but sugar maple, beech, and yellow birch occupied less extensive areas. Hemlocks and pines grew in small areas that were mostly cooler, wetter, and higher than the rest of the county.

The soils are typical of those developed under forest. Where they have not been disturbed, a layer of leaf litter covers the surface and is underlain by a black O<sub>2</sub> horizon 1 to 3 inches thick. The O<sub>2</sub> horizon is commonly underlain by a dark A<sub>1</sub> horizon 1 to 2 inches thick. Beneath the A<sub>1</sub> horizon is a light-colored A<sub>2</sub> horizon several inches thick, similar to the one in the profile described as representative of the Laidig series.

When the forests were cleared and the soils were farmed, the layers of organic matter were incorporated into the plow layer or burned. Thus, in many places the soils were exposed to wind and rain that produced accelerated erosion.

The activities of man, such as cultivation, liming, artificial drainage, manuring, and maintaining a cover of perennial grasses and legumes, have had major effects on the soil.

### **Time**

The length of time it has taken a soil to form is indicated, to some extent, by the degree of profile formation. Some soils, especially those that formed in alluvium, have a weakly defined profile because the soil material has not been in place long enough for distinct horizons to form. Examples of soils that formed in alluvium are the Philo, Holly, Melvin Variant, and Pope soils. These

soils are continually receiving fresh deposits of soil material on the surface. They are called young, or recent, soils.

The profile of Weikert, Berks, and Calvin soils shows that some changes have taken place in the parent material. These changes, however, do not represent advanced weathering. Weathering and the formation of horizons in those soils have been slowed by the relief and the kind of parent material.

The Bedington, Laidig, Penn, and Duffield soils have a well-defined profile. The parent material has been in place long enough for distinct horizons to form.

### **Processes of soil formation**

As weathering proceeds and plants grow on a young soil, several processes in soil formation become apparent. For example, soils gain material when leaves and plant remains accumulate on the surface. This accumulation is easily seen in areas of Chester, Hazleton, and other soils that formed under forest and have not been plowed. Additions of organic matter, chemicals, and mineral material are also brought in from adjacent areas by animals, floodwaters, and wind, or they are transferred as a result of gravity.

Losses occur when minerals decompose into products that are leached from the soils in solution. This process is apparent in the Duffield and Hagerstown soils, from which calcium carbonate has been removed. Losses also occur when plant nutrients are removed in harvested plants. In addition, fine particles of soil material are removed by erosion and gases escape as organic matter decomposes.

The transfer or translocation of material from one part of the soil to another is common in most soils. Organic matter is moved in suspension or solution from the upper part of the profile to the lower part. Calcium is leached from the surface layer and is held by the clay in the subsoil, as in the Duffield and Markes soils. Clay has accumulated in the B horizon as a result of transfer from higher horizons.

Bases and plant nutrients are moved upward. They are absorbed by the roots of plants and are stored in the leaves and twigs. When the plant dies and decays, the nutrients are returned to the soil.

Transformations occur as chemical weathering takes place. During this process, iron, aluminum, calcium, and other elements are released from the primary and secondary minerals in the soil. The gray and white colors of the parent material of a well drained Hagerstown soil, for example, gradually are replaced by the red, brown, and yellow colors of oxidized iron compounds. These color changes indicate that iron has been released or that ferrous oxide has been oxidized to ferric oxide in the presence of an adequate supply of oxygen.

## Horizon designations

The O1 and O2 horizons are generally the first to form on the accumulated, weathered parent material. The O2 horizon is the one in which the maximum amount of organic matter has accumulated.

The A horizon, or surface layer, is beneath the O2 horizon. Its formation parallels that of the O2 horizon. The A horizon is commonly divided into two layers, the A1 and the A2. The A1 horizon consists of mixed, dark, organic and mineral soil material. The A2 horizon, just beneath the A1 horizon, becomes apparent after weathering and leaching, or eluviation, have removed the soluble substances from the lower part of the A horizon. If the A horizon has been mixed in plowing and if crop residue and manure have been incorporated, this layer is designated as an Ap horizon.

The B horizon, or subsoil, is below the A horizon. It generally has a higher content of clay and a lower content of organic matter than the A horizon. The B horizon forms after the A horizon has formed. It is often called the illuviated horizon, or the horizon that has retained some of the substances, such as clay, iron, aluminum, oxides, and organic colloids, which have moved out of the A horizon. The B horizon also contains many secondary minerals, mainly silicate clay derived from altered primary minerals. The B horizon is a result of both illuviation and transformation.

The B horizon has three main subdivisions—the B1, B2, and B3 horizons. The B1 horizon has weakly defined features of the B horizon. The B2 horizon generally contains the largest amount of clay of any of these horizons. Hagerstown soils, for example, have a high content of clay in the B2 horizon, as shown in the profile described as representative of the series. The B3 horizon has some properties of the B horizon and some of the C horizon. In most soils it contains fewer altered primary minerals than the B2 horizon and less accumulation of clay.

Together, the A and B horizons constitute the solum, the zone in which most of the organic and mineral matter has been added, removed, transferred, or translocated through soil-forming processes.

Below the solum is the C horizon, or substratum. The C horizon consists of relatively unweathered parent material or contrasting material. In some places it contains material leached from both the A and B horizons as a result of weathering. The C horizon consists mainly of partly weathered minerals and fragments of rock.

Below the C horizon, in some soils, is an R horizon of consolidated bedrock, such as limestone, sandstone, or conglomerate.

## Classification

The system of soil classification used by the National Cooperative Soil Survey has six categories (10). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 17, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

**ORDER.** Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Entisol.

**SUBORDER.** Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

**GREAT GROUP.** Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Fluvaquents (*Fluv*, meaning recent water-deposited sediments, plus *aquent*, the suborder of Entisols that have an aquic moisture regime).

**SUBGROUP.** Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Fluvaquents.

**FAMILY.** Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consis-

tence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, nonacid, mesic, Typic Fluvaquents.

**SERIES.** The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistency, and mineral and chemical composition.

## Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (8). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

### Abbottstown series

The Abbottstown series consists of fine-loamy, mixed, mesic Aeric Fragiqualfs. These deep, somewhat poorly drained soils are on upland flats, in depressions, in drainageways, and at heads of streams. They have a dark brown silt loam Ap horizon, a reddish brown and dark reddish gray silt loam and silty clay loam Bt horizon, and a very firm and brittle Bx horizon.

The principal associated soils are the well drained Bucks, Ungers, Penn, and Klinesville soils and the moderately well drained Readington soils.

Typical pedon of Abbottstown silt loam, 0 to 3 percent slopes, in pasture, one-half mile northwest of Lawn:

Ap—0 to 8 inches; dark brown (7.5YR 3/2) silt loam; moderate thin and medium platy structure parting to medium granular; friable, slightly sticky, and slightly plastic; strongly acid; abrupt smooth boundary.

B21t—8 to 12 inches; reddish brown (5YR 4/4) silt loam; common medium faint pinkish gray (5YR 6/2) and fine distinct brown (7.5YR 5/2) mottles; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; common thick patchy clay

films on ped faces and lining pores; 2 percent coarse fragments; medium acid; clear smooth boundary.

B22t—12 to 20 inches; dark reddish gray (5YR 4/2) silty clay loam; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm, sticky and plastic; common thick patchy clay films on ped faces; 5 percent coarse fragments; medium acid; clear smooth boundary.

Bx1—20 to 36 inches; reddish brown (5YR 4/3) silty clay loam; many medium distinct yellowish red (5YR 4/8) mottles; moderate very coarse prismatic structure parting to coarse subangular blocky; very firm, brittle, slightly sticky and slightly plastic; common moderately thick patchy clay films on ped faces and lining pores; many coarse black coatings on peds; 10 percent coarse fragments; medium acid; clear smooth boundary.

Bx2—36 to 42 inches; dark reddish gray (5YR 4/2) heavy silty clay loam; common medium faint yellowish red (5YR 4/8) mottles; strong very coarse prismatic structure parting to coarse subangular blocky; very firm, brittle, sticky and slightly plastic; common moderately thick clay films on ped faces; common coarse black coatings on peds; 10 percent coarse fragments; strongly acid; clear smooth boundary.

B3g—42 to 60 inches; weak red (2.5YR 4/2) shaly light silty clay loam; many medium distinct dark reddish gray (5YR 4/2) and pale red (2.5YR 6/2) mottles; weak medium platy structure; friable; slightly sticky and slightly plastic; few patchy clay films on peds; few medium black coatings on peds; 20 percent coarse fragments; strongly acid; clear wavy boundary.

R—60 inches; weak red (10YR 4/2) fractured shale.

The solum thickness ranges from 30 to 60 inches. Depth to bedrock ranges from 40 to 60 inches or more. Depth to the fragipan ranges from 15 to 30 inches. Content of fragments ranges from 0 to 15 percent in the upper part of the solum and 10 to 30 percent in the lower part. In unlimed areas, reaction ranges from extremely acid to strongly acid in the upper part of the solum and from strongly acid to slightly acid in the lower part.

The Ap horizon ranges from dark brown (7.5YR 3/2) to dark reddish gray (5YR 4/2).

The Bt horizon ranges from weak red (10YR 4/3) through reddish brown (5YR 5/4) in the upper part and from reddish gray (10YR 6/1) to dark reddish gray (5YR 4/2) in the lower part. It has brownish or grayish mottles throughout. Texture ranges from loam through silty clay loam in the fine earth fraction. The Bx horizon ranges from dark gray (N 4/ ) through reddish brown (5YR 4/4). Mottles are dominantly yellowish red (5YR 4/8) but are both high and low in chroma and 5YR to 7.5YR in hue.

## Bedington series

The Bedington series consists of fine-loamy, mixed, mesic Typic Hapludults. These deep, well drained soils are on convex slopes in dissected uplands. They have a dark yellowish brown shaly silt loam Ap horizon, a reddish brown and reddish yellow shaly silty clay loam and yellowish red shaly heavy silt loam and very shaly silt loam B horizon, and a red very shaly silt loam C horizon.

The principal associated soils are the shallow, well drained Klinesville and Weikert soils; the moderately deep, well drained Berks soil; and the deep, moderately well drained and somewhat poorly drained Comly soils.

Typical pedon of Bedington shaly silt loam, 3 to 8 percent slopes, in pasture, 1 mile north of Lebanon along Pennsylvania Route 343:

Ap—0 to 9 inches; dark yellowish brown (10YR 4/4) shaly silt loam; weak fine granular structure; friable, slightly sticky and slightly plastic; 15 percent coarse fragments; neutral; abrupt wavy boundary.

B21t—9 to 16 inches; reddish brown (5YR 4/4) shaly silty clay loam; weak fine and medium subangular blocky structure; friable, sticky and slightly plastic; few clay films on ped faces; 20 percent coarse fragments; neutral; clear wavy boundary.

B22t—16 to 20 inches; reddish yellow (5YR 6/6) shaly silty clay loam; weak fine and medium subangular blocky; friable, slightly sticky and slightly plastic; few thin discontinuous clay films on ped faces; 30 percent coarse fragments; slightly acid; clear wavy boundary.

B23t—20 to 29 inches; yellowish red (5YR 5/6) shaly heavy silt loam; weak fine and medium blocky structure modified by shale fragments; friable, sticky and slightly plastic; common medium patchy clay films on ped faces and ped interiors; 40 percent coarse fragments; strongly acid; clear wavy boundary.

B24t—29 to 35 inches; yellowish red (5YR 5/6) very shaly silt loam; weak medium blocky structure; firm, slightly sticky and slightly plastic; common medium clay films in pores; many black coats on peds; 75 percent coarse fragments; very strongly acid; gradual wavy boundary.

B3—35 to 48 inches; yellowish red (5YR 5/8) very shaly silt loam; weak medium blocky structure; very firm, slightly sticky and slightly plastic; common medium clay films on shales and in pores; few black coats on peds; 80 percent coarse fragments; very strongly acid; gradual wavy boundary.

C1—48 to 66 inches; red (2.5YR 4/8) very shaly silt loam; massive; friable, slightly sticky and slightly plastic; common medium clay films on shale; iron coats on shale; 80 percent coarse fragments; very strongly acid; irregular boundary.

C2—66 to 72 inches; red (2.5YR 4/8) very shaly silt loam; massive; friable, slightly sticky and slightly

plastic; common medium clay films on shale; 85 percent coarse fragments; strongly acid.

The solum ranges from 40 to 70 inches in thickness. Bedrock is at a depth of 3-1/2 inches to 10 feet or more. Reaction ranges from very strongly acid to neutral in the upper part of the solum and is very strongly acid or strongly acid in the lower part and in the C horizon. Content of coarse fragments ranges from 10 to 20 percent in the A horizon and from 15 to 40 percent in the upper part of the B horizon and 20 to 85 percent in the lower part and C horizon.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) to dark yellowish brown (10YR 4/4).

The B horizon ranges from dark yellowish brown (10YR 4/4) to reddish yellow (5YR 6/8). Texture ranges from silt loam to light clay loam in the fine earth fraction.

The C horizon ranges from dark yellowish brown (10YR 4/4) to yellowish red (5YR 4/8).

## Berks series

The Berks series consists of loamy-skeletal, mixed, mesic Typic Dystrochrepts. These moderately deep, well drained soils are on rounded and dissected uplands. They have a dark brown shaly silt loam Ap horizon, a strong brown shaly and very shaly silt loam B horizon, and a yellowish brown very shaly silt loam C horizon over dark grayish brown and yellow fractured shale bedrock.

The principal associated soils are the shallow, well drained Klinesville and Weikert soils; the deep, well drained Bedington soils; and the deep, moderately well drained and somewhat poorly drained Comly soils.

Typical pedon of Berks shaly silt loam, 3 to 8 percent slopes, in idle field, 2 miles south of Bunker Hill along Pennsylvania Route 72:

Ap—0 to 9 inches; dark brown (10YR 4/3) shaly silt loam; weak fine and medium granular structure; friable, slightly sticky and slightly plastic; 25 percent coarse fragments; strongly acid; abrupt smooth boundary.

B2—9 to 15 inches; strong brown (7.5YR 5/6) shaly silt loam; weak fine and medium subangular blocky structure; friable slightly sticky and slightly plastic; few thin patchy clay films on shale fragments; many black coats on peds; 50 percent coarse fragments; strongly acid; clear wavy boundary.

B3—15 to 28 inches; strong brown (7.5YR 5/8) very shaly silt loam; weak fine subangular blocky structure modified by shale fragments; friable slightly sticky, and slightly plastic; few thin patchy silt and clay films on shale fragments; many black coats on shale fragments; 75 percent coarse fragments; strongly acid; clear wavy boundary.



C—28 to 33 inches; yellowish brown (10YR 5/6) very shaly silt loam as coats on shale fragments; massive; friable; slightly sticky and slightly plastic; few thin patchy clay films on shale; many black coats on shale fragments; 80 percent coarse fragments; medium acid; irregular boundary.

R—33 inches; dark grayish brown (2.5Y 4/2) and yellow (10YR 7/6) fractured shale bedrock.

The solum thickness ranges from 18 to 36 inches. Bedrock is at a depth of 20 to 40 inches. Content of coarse fragments ranges from 10 to 50 percent in the A horizon, 25 to 75 percent in the B horizon, and 60 to 80 percent in the C horizon. In unlimed areas, reaction is very strongly acid or strongly acid in the solum and very strongly acid to medium acid in the C horizon.

The Ap horizon ranges from dark brown (10YR 4/3) to brown (10YR 5/3).

The B horizon ranges from yellowish brown (10YR 5/8) to yellowish red (5YR 4/6). The fine earth fraction is silt loam or loam.

The C horizon is similar in color to the B horizon. The fine earth fraction is dominantly silt loam.

### Bowmansville series

The Bowmansville series consists of fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents. These deep, poorly drained and somewhat poorly drained soils are on flood plains. They have a dark brown silt loam Ap horizon and a dark reddish brown, brown, and dark reddish gray silt loam B horizon which is mottled below a depth of 12 inches. The C horizon is stratified sand and gravel.

The principal associated soils are Abbottstown, Brinkerton, Bucks, and Rowland soils. Abbottstown and Brinkerton soils have an argillic horizon and a fragipan. Bucks soil is well drained and has an argillic horizon. These three soils are on nearby uplands. The moderately well to somewhat poorly drained, nearly level Rowland soils formed in similar material and are on associated flood plains.

Typical pedon of Bowmansville silt loam, in pasture one-half mile north of Lawn of Pennsylvania Route 241:

Ap—0 to 7 inches; dark brown (7.5YR 4/2) silt loam; weak fine granular structure; friable and slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

B1—7 to 13 inches; dark reddish brown (5YR 3/4) silt loam; weak coarse and medium subangular blocky structure; friable, slightly sticky and slightly plastic; few thin silt films in pores and root channels; neutral; clear wavy boundary.

B21—13 to 26 inches; brown (7.5YR 5/2) silt loam; common medium distinct reddish yellow (5YR 6/8) mottles; weak coarse subangular blocky structure;

friable, slightly sticky and slightly plastic; few thin silt films in large pores; neutral; clear wavy boundary.

B22g—26 to 40 inches; dark reddish gray (5YR 4/2) silt loam; common medium faint reddish yellow (5YR 6/8) mottles; weak coarse subangular blocky structure; firm slightly sticky and slightly plastic; few thin silt films in large pores; 2 percent coarse fragments; neutral; clear wavy boundary.

IIC—40 to 60 inches; stratified sand and gravel; neutral.

The solum ranges from 24 to 40 inches in thickness. Depth to stratified sand and gravel is 40 inches or more. Content of coarse fragments ranges from 0 to 10 percent in the A and B horizons and 0 to 30 percent in the C horizon. Reaction ranges from strongly acid to neutral.

The Ap horizon ranges from dark brown (7.5YR 4/2) to reddish brown (5YR 4/4).

The B horizon ranges from dark reddish brown (5YR 3/2) to brown (7.5YR 5/2). The fine earth fraction ranges from silt loam to light silty clay loam. Mottles are below 12 inches and are gray (7.5YR N 5/ ), grayish brown (10YR 5/2), reddish yellow (5YR 6/8), and strong brown (7.5YR 5/8).

Where present, the C horizon is uniformly gray (N 5/ ) or variegated with dark reddish brown (5YR 3/2), gray (N 5/ ), and dark brown (7.5YR 3/2). The fine earth fraction ranges from sandy loam to sandy clay loam. The IIC horizon is stratified sand and gravel.

### Brecknock series

The Brecknock series consists of fine-loamy, mixed, mesic Ultic Hapludalfs. These deep, well drained soils are on hills and low ridges. They have a very dark grayish brown silt loam Ap horizon, a dark grayish brown silt loam and channery silt loam B horizon, and a very dark gray channery silt loam C horizon over very dark gray to dark bluish gray, porcelainite bedrock.

The principal associated soils are the deep, well drained Bucks, Neshaminy, and Ungers soils; the moderately well to somewhat poorly drained Lehigh soils; the moderately well and somewhat poorly drained Mount Lucas soils; the somewhat poorly drained Abbottstown soils; and the poorly drained Watchung soils.

Typical pedon of Brecknock channery silt loam, 3 to 8 percent slopes, in cultivated field, 1.5 miles northeast of the Upper Lawn about 600 feet east of the junction of Pennsylvania 117 and T331:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) channery silt loam, light grayish brown (10YR 6/2) dry; moderate fine granular structure; friable slightly sticky and slightly plastic; 15 percent coarse fragments; neutral; abrupt smooth boundary.

B21t—8 to 20 inches; dark grayish brown (2.5Y 4/2) silt loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; few thin

patches of clay films on ped faces; 10 percent coarse fragments; slightly acid; clear smooth boundary.

B22t—20 to 28 inches; dark grayish brown (2.5Y 4/2) heavy silt loam; moderate medium subangular blocky structure; firm, slightly sticky and plastic; few thin patches of clay films on ped faces; few medium black oxide coatings on ped faces; 10 percent coarse fragments; medium acid; clear smooth boundary.

B3—28 to 36 inches; dark grayish brown (10YR 4/2) channery silt loam; weak medium subangular blocky structure; firm slightly sticky and slightly plastic; common medium and coarse black oxide coatings on ped faces; 15 percent coarse fragments; medium acid; clear smooth boundary.

C—36 to 46 inches; very dark gray (10YR 3/1) channery silt loam; massive with slight evidence of weak medium subangular blocky structure; firm, slightly sticky and slightly plastic; 40 percent coarse fragments; strongly acid; clear wavy boundary.

R—46 inches; very dark gray to dark bluish gray, slightly weathered porcelanite.

The solum ranges from 24 to 40 inches in thickness. Depth to bedrock ranges from 40 to 60 inches. Content of coarse fragments ranges from 10 to 35 percent in the solum and 15 to 70 percent in the C horizon. In unlimed areas, reaction is medium acid to very strongly acid in the B and C horizons.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) to dark brown (10YR 4/3).

The B horizon ranges from dark grayish brown (10YR 4/2 or 2.5Y 4/2) through brown (10YR 5/3) and dark brown (10YR 4/4) to olive (5Y 5/3). The fine earth fraction in the B horizon ranges from silt loam to clay loam.

The C horizon ranges from very dark gray (10YR 3/1), dark grayish brown (2.5Y 4/2), and olive brown (2.5Y 4/4) through bluish gray (5B 5/1). The fine earth fraction ranges from silt loam to clay loam.

### Brinkerton series

The Brinkerton series consists of fine-silty, mixed, mesic Typic Fragiqualfs. These deep, nearly level to gently sloping, poorly drained soils are on concave foot slopes and flats bordering streams. They have a dark grayish brown silt loam Ap horizon and grayish brown and light brownish gray silty clay loam Btg and Bx horizons.

The principal associated soils are the shallow, well drained Klinesville and Weikert soils; the moderately deep, well drained Berks soils; and the deep, moderately well drained and somewhat poorly drained Comly soils.

Typical pedon of Brinkerton silt loam, 0 to 3 percent slopes, in pasture, one mile north of Legislative Route 38050, northeast of Fredricksburg:

Ap—0 to 8 inches; dark grayish brown (2.5Y 4/2) silt loam; moderate fine granular structure; friable, slightly sticky and slightly plastic; medium acid; abrupt smooth boundary.

B21tg—8 to 12 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium prominent yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; friable, sticky and plastic; moderately thick clay films in pores and on ped faces; medium acid; gradual wavy boundary.

B22tg—12 to 26 inches; light brownish gray (2.5Y 6/2) silty clay loam; common coarse distinct strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; friable, sticky and plastic; thin clay flows in pores; medium acid; gradual wavy boundary.

Bxg—26 to 48 inches; light brownish gray (2.5Y 6/2) silty clay loam; common coarse prominent strong brown (7.5YR 5/8) mottles; moderate very coarse prismatic structure parting to moderate medium angular blocky; very firm and brittle, slightly sticky and plastic; thin greenish gray (5BG 6/1) clay flows in pores and on ped faces; few black oxide coatings; 5 percent coarse fragments; medium acid; clear wavy boundary.

Cxg—48 to 62 inches; gray (N 5/ ) silty clay loam; many coarse prominent strong brown (7.5YR 5/8) mottles; massive; very firm, slightly sticky and plastic; thick gray (5Y 6/1) clay flows in pores; few black oxide coatings; 10 percent coarse fragments; medium acid.

The solum thickness ranges from 40 to 50 inches. Depth to bedrock is more than 60 inches. Depth to the fragipan ranges from 15 to 30 inches. Content of coarse fragments ranges from 0 to 10 percent above the fragipan, from 2 to 20 percent in the fragipan, and from 10 to 75 percent in the C horizon. In unlimed areas, reaction ranges from very strongly acid to medium acid in the solum.

The Ap horizon ranges from dark grayish brown (2.5Y 4/2) to grayish brown (10YR 5/2).

The B2tg horizon ranges from light brownish gray (10YR 6/2) to grayish brown (2.5Y 5/2). The fine earth fraction is heavy silt loam or silty clay loam. The Bx horizon ranges from gray (N 6/ ) to light brownish gray (2.5Y 6/2). The fine earth fraction is silt loam or silty clay loam. Mottles in the B horizon range from gray (N 5/ or N 6/ ) to yellowish brown (10YR 5/8) and yellowish red (5YR 4/6 to 5/8).

### Buchanan series

The Buchanan series consists of fine-loamy, mixed, mesic, Aquic Fragiudults. These deep, moderately well drained and somewhat poorly drained soils are on concave foot slopes and midslopes of mountains. They have

a very dark gray gravelly loam A1 horizon and yellowish brown loam Bt horizon over a very firm and brittle, strong brown loam and yellowish red gravelly clay loam Bx horizon.

The principal associated soils are the deep, well drained Laidig soils; the moderately deep, well drained Berks soils; and the deep, very poorly drained to poorly drained Holly soils.

Typical pedon of Buchanan gravelly loam in an area of Buchanan extremely stony loam, 3 to 8 percent slopes, in woods, three-fourths mile northeast of Memorial Lake State Park, Edward Martin Military Reservation:

- O1—1 to 1/2 inch; undecomposed poplar, oak, birch, and hemlock leaf mat.
- O2—1/2 inch to 0; fibrous organic mat held together by roots and mycelium; 50 percent stone-size coarse fragments; abrupt smooth boundary.
- A1—0 to 3 inches; very dark gray (10YR 3/1) gravelly loam; weak fine granular structure; friable nonsticky and nonplastic; 35 percent coarse fragments; very strongly acid; clear smooth boundary.
- B1—3 to 8 inches; light yellowish brown (10YR 6/4) gravelly loam; weak medium subangular blocky structure; friable, nonsticky and slightly plastic; few fine tree roots; 35 percent coarse fragments; very strongly acid; clear wavy boundary.
- B2t—8 to 23 inches; yellowish brown (10YR 5/6) loam; common fine distinct light gray (2.5Y 7/2) mottles; strong to moderate, coarse to medium subangular blocky structure; firm, slightly sticky and slightly plastic; common thin patchy clay films on ped interiors and in pores; 5 percent coarse fragments; very strongly acid; clear wavy boundary.
- Bx1—23 to 40 inches; strong brown (7.5YR 5/6) loam; many medium distinct light brownish gray (2.5Y 6/2) mottles as streaks, bands, and prism cracks; moderate very coarse prismatic structure parting to coarse subangular blocky; very firm and brittle, slightly sticky and slightly plastic; common thin patchy clay films on ped interiors and in pores; many black oxide coatings on peds; 10 percent coarse fragments; strongly acid; clear wavy boundary.
- Bx2—40 to 60 inches; yellowish red (5YR 4/6) gravelly clay loam; many medium distinct light brownish gray (2.5Y 6/2) and few medium distinct brownish yellow (10YR 6/6) mottles as streaks, bands, and prism cracks; moderate very coarse prismatic structure parting to medium subangular blocky; very firm and brittle, sticky and plastic; thin patches of clay films on prism faces and secondary ped faces; many black oxide coatings on peds; 45 percent coarse fragments; very strongly acid.

The solum ranges from 40 to 60 inches in thickness. Depth to bedrock ranges from 5 to 15 feet or more. Depth to the fragipan ranges from 20 to 36 inches.

Content of coarse fragments ranges from 5 to 40 percent above the Bx horizon and from 10 to 60 percent in the Bx horizon. In unlimed areas, reaction ranges from extremely acid to strongly acid throughout.

The Ap horizon ranges from very dark gray (10YR 3/1) to light brown (7.5YR 6/4).

The B1 horizon ranges from yellowish brown (10YR 5/4) to light yellowish brown (10YR 6/4). The Bt horizon ranges from pale brown (10YR 6/3) to strong brown (7.5YR 5/6). Fine earth fraction is silt loam to clay loam. The Bx horizon ranges from brownish yellow (10YR 6/6) to reddish brown (5YR 4/3). The fine earth fraction ranges from silt loam to gravelly clay loam.

## Bucks series

The Bucks series consists of fine-loamy, mixed, mesic Typic Hapludults. These deep, well drained soils are on convex side slopes of dissected uplands. They have a dark reddish brown silt loam Ap horizon, a weak red silt loam and silty clay loam B horizon, and a weak red very channery silty clay loam C horizon.

The principal associated soils are the shallow, well drained Klinesville soils; the moderately deep, well drained Penn soils; the deep, moderately well drained Readington soils; the deep, somewhat poorly drained Abbottstown soils; the deep, poorly drained Brinkerton soils; the deep, moderately well drained to somewhat poorly drained Rowland soils; and the deep, poorly drained and somewhat poorly drained Bowmansville soils.

Typical pedon of Bucks silt loam, 3 to 8 percent slopes, in a woodland 0.4 mile south of Mt. Grenta Heights on Legislative Route 3806I and 0.3 mile west on dirt path:

- O1—3 to 2 inches; undecomposed leaf and twig litter.
- O2—2 inches to 0; very dark gray (10YR 3/1) organic mat.
- A1—0 to 5 inches; dark reddish brown (5YR 3/4) silt loam; weak fine granular structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; very strongly acid; abrupt smooth boundary.
- B1—5 to 20 inches; weak red (10R 4/4) silt loam; moderate coarse subangular blocky structure; friable, slightly sticky and slightly plastic; very strongly acid; clear wavy boundary.
- B21t—20 to 30 inches; weak red (10R 4/4) silty clay loam; moderate coarse subangular blocky structure; friable, slightly sticky and slightly plastic; thin clay films in pores, coating sand grains, and on ped faces; 5 percent coarse fragments; very strongly acid; clear wavy boundary.
- B22t—30 to 40 inches; weak red (10R 4/4) silty clay loam; moderate coarse subangular blocky structure; firm, slightly sticky and slightly plastic; thin clay films

in pores and on ped faces; 5 percent coarse fragments; very strongly acid; clear wavy boundary.

IIC—40 to 60 inches; weak red (10R 4/4) very channery silty clay loam; massive; firm; many black oxide coatings on coarse fragments; 50 percent coarse fragments; very strongly acid.

The solum thickness ranges from 30 to 40 inches. Depth to bedrock is 40 to 55 inches or more. Content of coarse fragments ranges from 0 to 5 percent in the A horizon and upper part of the B horizon, from 5 to 30 percent in the lower part of the B horizon, and 10 to 50 percent in the IIC horizon. In unlimed areas, reaction is strongly acid or very strongly acid throughout.

The A horizon ranges from weak red (2.5YR 4/2) to reddish brown (5YR 5/4).

The B<sub>1</sub> horizon ranges from weak red (10YR 4/4) and dark red (10R 3/6) to red (2.5YR 4/6). The fine earth fraction is silt loam or loam.

The B<sub>2t</sub> horizon ranges from dusky red (10R 3/3) through weak red (10R 4/4) to strong brown (7.5YR 4/6). Texture ranges from loam to silty clay loam in the fine earth fraction.

The C horizon ranges from dark reddish brown (5YR 3/4) to weak red (10R 4/1). Texture ranges from loam to clay loam in the fine earth fraction.

### Calvin series

The Calvin series consists of loamy-skeletal, mixed, mesic Typic Dystrachrepts. These moderately deep, well drained soils are on convex side slopes of dissected uplands. They have a dark reddish brown shaly silt loam A horizon, a weak red and reddish brown very shaly light clay loam B horizon, and a weak red very shaly loam C horizon over highly fractured shale.

The principal associated soils are Bedington, Berks, Klinsville, and Ungers soils. Bedington and Ungers soils are deep and have an argillic horizon. Berks soils have hue of yellowish brown. Klinsville soils are shallow.

Typical pedon of Calvin shaly silt loam in an area of Ungers and Calvin soils, steep, 1.75 miles northeast of Green Point on Pennsylvania Route 443 in wooded area about 500 feet east of road:

A<sub>1</sub>—0 to 6 inches; dark reddish brown (5YR 3/4) shaly silt loam; strong medium granular structure; friable, slightly sticky and slightly plastic; many roots; 20 percent coarse fragments; medium acid; abrupt smooth boundary.

B<sub>2</sub>—6 to 16 inches; weak red (10R 4/4) very shaly light clay loam; weak coarse subangular blocky structure; friable, slightly sticky and slightly plastic; few thin clay films lining pores and root channels; few roots; 50 percent coarse fragments; medium acid; gradual wavy boundary.

B<sub>3</sub>—16 to 27 inches; reddish brown (2.5YR 4/4) very shaly light clay loam; weak coarse subangular blocky structure; friable, slightly sticky and slightly plastic; few thin clay films lining pores and root channels; 55 percent coarse fragments; medium acid; gradual wavy boundary.

C<sub>1</sub>—27 to 36 inches; weak red (10R 4/3) very shaly loam; weak coarse subangular blocky structure; friable, slightly sticky and slightly plastic; many thin clay films in pores and patches of films on coarse fragments; 60 percent coarse fragments; strongly acid; clear wavy boundary.

C<sub>2</sub>—36 to 40 inches; weak red (10R 4/3) very shaly loam; structure obscured by coarse fragments; friable, slightly sticky and slightly plastic; few thin patches of clay films on coarse fragments; 80 percent coarse fragments; very strongly acid; clear wavy boundary.

R—40 inches; weak red (10R 4/3) shale, highly fractured in place; very strongly acid.

The solum thickness ranges from 20 to 35 inches. Depth to bedrock ranges from 20 to 40 inches. Content of coarse fragments ranges from 15 to 25 percent in the A horizon, 25 to 55 percent in the B horizon, and 40 to 80 percent in the C horizon. Reaction ranges from medium acid to very strongly acid throughout the profile.

The A<sub>p</sub> horizon is dark reddish brown (5YR 3/4) or reddish brown (5YR 4/4).

The B horizon ranges from reddish brown (5YR 4/4) to weak red (10YR 4/3 and 10R 4/4). The fine earth fraction ranges from silt loam to light clay loam.

The C horizon is dominantly weak red (10R 4/3 or 10R 4/4). The fine earth fraction is dominantly loam, but ranges to silt loam.

### Chester series

The Chester series consists of fine-loamy, mixed, mesic Typic Hapludults. These deep, well drained soils are on convex foot slopes, side slopes and ridgetops of mountains. They have a dark yellowish brown channery loam A horizon, yellowish red and strong brown channery loam and channery silty clay loam B<sub>t</sub> and B<sub>3</sub> horizons, and a strong brown very channery loam C horizon.

The principal associated soils are the deep, well drained Hazleton and Laidig soils, and the deep, moderately well drained and somewhat poorly drained Buchanan soils. Chester soils formed in material weathered from schist and gneiss; the Hazleton and Laidig soils formed in material weathered from acid sandstone.

Typical pedon of Chester channery loam, in an area of Chester extremely stony loam, 8 to 25 percent slopes, in woodland, 2 miles southeast of Newmanstown near Legislative Route 38014:

- O1—2 inches to 1 inch; undecomposed birch, maple, yellow-poplar, ash, and oak leaf and twig litter.
- O2—1 inch to 0; very dark grayish brown (10YR 3/2) organic mat held together by roots and mycelium; 75 percent stone-size rock fragments.
- A1—0 to 5 inches; dark yellowish brown (10YR 3/4) channery loam; weak fine granular structure; friable, slightly sticky and slightly plastic; many fine roots, 20 percent coarse fragments; strongly acid; clear wavy boundary.
- A2—5 to 10 inches; dark yellowish brown (10YR 4/4) channery loam; weak fine and medium granular structure; friable, slightly sticky and slightly plastic; many fine roots; 30 percent coarse fragments; strongly acid; gradual wavy boundary.
- B21t—10 to 19 inches; yellowish red (5YR 4/6) channery heavy loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; common thick patches of clay films on ped surfaces and lining pores; many fine roots; 20 percent coarse fragments; strongly acid; gradual wavy boundary.
- B22t—19 to 31 inches; strong brown (7.5YR 5/8) channery silty clay loam; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; thin patches of clay films on ped faces and lining pores; many fine roots; 25 percent coarse fragments; strongly acid; clear wavy boundary.
- B3—31 to 44 inches; strong brown (7.5YR 5/8) channery loam; moderate medium subangular blocky structure; friable, nonsticky and nonplastic; few fine roots; 40 percent coarse fragments; strongly acid; gradual wavy boundary.
- C—44 to 60 inches; strong brown (7.5YR 5/6) very channery loam; moderate medium subangular blocky structure; firm, nonsticky and nonplastic; 80 percent coarse fragments; very strongly acid.

Solum thickness ranges from 30 to 50 inches. Depth to bedrock is more than 5 feet. Content of coarse fragments ranges from 5 to 30 percent in the A horizon, 20 to 40 percent in the B horizon, and 50 to 80 percent in the C horizon. In unlimed areas, the reaction is strongly acid or very strongly acid.

The A horizon ranges from very dark grayish brown (10YR 3/2) to dark yellowish brown (10YR 4/4).

The Bt horizon ranges from strong brown (7.5YR 4/6) to yellowish red (5YR 5/8). The fine earth fraction ranges from loam to clay loam and silty clay loam. The B3 horizon ranges from brown (10YR 4/3) and strong brown (7.5YR 4/6) to a reddish brown (5YR 4/4) and yellowish red (5YR 4/8).

The C horizon ranges from strong brown (7.5YR 5/6, 5/8) to dark brown (10YR 4/3) and is commonly variegated. The fine earth fraction is dominantly loam.

## Clarksburg series

The Clarksburg series consists of fine-loamy, mixed, mesic Typic Fragiudalfs. These deep, moderately well drained soils are on concave areas on the uplands. They have a dark brown silt loam Ap horizon and a yellowish brown silty clay loam Bt horizon over a firm and brittle Bx horizon.

The principal associated soils are the deep, well drained Duffield and Hagerstown soils; the deep, poorly drained Thorndale soils; and the deep, well drained Nolin Variant soils. The Nolin Variant soils are on flood plains.

Typical pedon of Clarksburg silt loam, 3 to 8 percent slopes, in pasture, 3.5 miles southeast of Lebanon:

- Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable, nonsticky and slightly plastic; 4 percent coarse fragments; slightly acid; abrupt smooth boundary.
- B1—9 to 12 inches; light yellowish brown (10YR 6/4) silt loam; moderate fine subangular blocky structure; friable, nonsticky and slightly plastic; medium acid; clear wavy boundary.
- B2t—12 to 22 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium and fine subangular blocky structure; friable, slightly sticky and slightly plastic; common thin clay films on ped surfaces; medium acid; abrupt smooth boundary.
- Bx1—22 to 28 inches; yellowish brown (10YR 5/4) heavy silt loam; many fine and medium prominent yellowish red (5YR 4/6) and faint light brownish gray (10YR 6/2) mottles; dark yellowish brown (10YR 4/4) prism faces; weak very coarse prismatic structure parting to moderate thick platy; firm and brittle, slightly sticky and slightly plastic; common thin clay films on plates and thick continuous clay films on prism faces; 5 percent coarse fragments; strongly acid; gradual wavy boundary.
- Bx2—28 to 38 inches; yellowish brown (10YR 5/4) silty clay loam; many fine and medium prominent yellowish red (5YR 4/6) and faint light yellowish brown (10YR 6/2) mottles; dark yellowish brown (10YR 4/4) prism faces; weak very coarse prismatic structure parting to moderate medium platy; firm and brittle, nonsticky and slightly plastic; common thin clay films on plates and thick, continuous clay films on prism faces; 5 percent coarse fragments; strongly acid; abrupt irregular boundary.
- B31—38 to 50 inches; brownish yellow (10YR 6/8) light silt loam; many fine and medium variegated prominent yellowish red (5Y 5/6) and distinct strong brown (7.5YR 5/6) mottles on ped faces; brown (7.5YR 5/2) prism faces; weak very coarse prismatic structure parting to moderate medium platy; friable, nonsticky and nonplastic; thick continuous clay films on prism faces; 5 percent coarse fragments; strongly acid; clear wavy boundary.

B32—50 to 62 inches; strong brown (7.5YR 5/6) light silt loam; common medium distinct yellowish red (5YR 5/8) and light brownish gray (10YR 6/2) mottles on plate faces; faint brown (7.5YR 5/4) mottles on prism faces; weak very coarse prismatic structure parting to weak medium platy; friable, nonsticky and nonplastic; thin patchy clay films on plate faces and thick continuous clay films on prism faces; common black oxide coatings on peds; 5 percent coarse fragments; strongly acid; clear wavy boundary.

C1—62 to 75 inches; strong brown (7.5YR 5/6) and yellow (10YR 7/6) variegated light silt loam; common medium distinct brown (7.5YR 5/4) mottles; massive; friable to firm, nonsticky and nonplastic; thick continuous clay films on prism faces; 5 percent coarse fragments; strongly acid; clear wavy boundary.

C2—75 to 81 inches; brownish yellow (10YR 6/6), yellow (10YR 7/6), and reddish yellow (7.5YR 6/6) variegated bands of loam and silt loam 4 to 8 inches thick; common medium yellowish red (5YR 5/8) mottles; massive; friable to firm, nonsticky and nonplastic; thick continuous clay films on prism faces; common black oxide coatings on peds; 10 percent coarse fragments; strongly acid.

The solum ranges from 40 to 70 inches in thickness. Depth to bedrock is more than 5 feet. Depth to the fragipan ranges from 20 to 36 inches. Content of coarse fragments ranges from 0 to 20 percent above the fragipan, 5 to 30 percent in the fragipan, and 5 to 80 percent in the C horizon. In unlimed areas, reaction ranges from strongly acid to slightly acid throughout.

The Ap horizon ranges from dark brown (10YR 4/3) to dark grayish brown (10YR 3/2).

The B horizon ranges from dark brown (7.5YR 4/4) to yellowish brown (10YR 5/8). Depth to mottles of chroma of 2 or less ranges from 20 to 32 inches. The fine earth fraction ranges from silt loam to silty clay loam. The Bx horizon is reddish brown (5YR 4/3) to yellowish brown (10YR 5/6) with gray to strong brown prism faces, reddish brown to yellowish brown ped faces, and gray, yellowish brown, or strong brown mottles. The fine earth fraction ranges from silt loam to silty clay loam.

The C horizon ranges from brownish yellow (10YR 6/6) to strong brown (7.5YR 5/8) with mottles of brown (7.5YR 5/4) and yellowish red (5YR 5/8). The fine earth fraction is silt loam to clay.

### Comly series

The Comly series consists of fine-loamy, mixed, mesic Typic Fragiudalfs. These deep, moderately well drained and somewhat poorly drained soils are on concave lower foot slopes, in drainageways, and on broad upland flats. They have a dark brown silt loam Ap horizon and a

yellowish brown shaly silt loam Bt horizon over a firm and very firm and brittle, yellowish brown silt loam and shaly silt loam Bx horizon.

The principal associated soils are the deep, well drained Bedington soils; the moderately deep, well drained Berks soils; the shallow Klinesville and Weikert soils; and the deep, poorly drained Brinkerton soils.

Typical pedon on Comly silt loam, 3 to 8 percent slopes, in cultivated field, three-fifths mile south of Mt. Zion:

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam; weak fine granular structure; friable, slightly sticky and slightly plastic; many small roots; 10 percent coarse fragments; slightly acid; abrupt smooth boundary.

B21t—9 to 20 inches; yellowish brown (10YR 5/4) shaly silt loam; weak coarse prismatic structure parting to coarse subangular blocky; friable, slightly sticky and slightly plastic; few small roots; few thin continuous clay films lining pores; 20 percent coarse fragments; slightly acid; gradual wavy boundary.

B22t—20 to 32 inches; yellowish brown (10YR 5/4) shaly silt loam; common medium faint yellowish brown (10YR 5/8) and light gray (10YR 7/2) mottles; weak coarse prismatic structure parting to coarse subangular blocky; firm, slightly sticky and plastic; few thin continuous clay films lining pores and on pressure faces; few black coatings on ped interiors; few roots; 20 percent coarse fragments; strongly acid; gradual wavy boundary.

Bx1—32 to 47 inches; yellowish brown (10YR 5/4) silt loam; many medium faint strong brown (7.5YR 5/6) and grayish brown (2.5Y 5/2) mottles; strong very coarse prismatic structure parting to coarse and medium prismatic; firm and brittle, slightly sticky and slightly plastic; few thin continuous clay films lining pores; few black coatings on ped interiors; 10 percent coarse fragments; medium acid; gradual wavy boundary.

Bx2—47 to 61 inches; yellowish brown (10YR 5/4) shaly silt loam; few medium faint gray (7.5YR N 5/ ) and pale brown (10YR 6/3) mottles; weak medium prismatic structure parting to coarse subangular blocky; very firm and brittle, slightly sticky and slightly plastic; few thin continuous clay films lining pores; many black coatings on ped interiors; 40 percent coarse fragments; medium acid.

The solum thickness ranges from 40 to 70 inches. Depth to the fragipan ranges from 20 to 35 inches. Depth to bedrock is 4 to 8 feet. Content of coarse fragments ranges from 0 to 20 percent in the upper part of the solum and from 10 to 60 percent in the fragipan and C horizon. In unlimed areas, the upper part of the solum is very strongly acid or strongly acid and the fragipan and C horizon are strongly acid to medium acid.



The Ap horizon ranges from grayish brown (10YR 5/2) to dark brown (10YR 4/3).

The Bt horizon ranges from brown (10YR 5/3) to light yellowish brown (10YR 6/4) with mottles of yellowish brown, light gray, and gray. Mottles with chromas of 2 or less are at depths of 18 to 30 inches. Texture ranges from silt loam to silty clay loam in the fine earth fraction. The Bx horizon ranges from brown (7.5YR 5/4) to yellowish brown (10YR 5/6) with faint mottles of strong brown, pale brown, grayish brown, and gray. Texture ranges from silt loam to loam in the fine earth fraction.

### Duffield series

The Duffield series consists of fine-loamy, mixed, mesic Ultic Hapludalfs. These deep, well drained soils are on undulating uplands. They have a dark brown silt loam Ap horizon, a yellowish brown silty clay loam and loam Bt horizon, and a light olive brown loam C horizon.

The principal associated soils are the deep, well drained Hagerstown and Nolin Variant soils; the deep, moderately well drained Clarksburg soils; and the deep, poorly drained Thorndale and Melvin Variant soils. Nolin Variant and Melvin Variant soils are on flood plains. Duffield soils are less red and have less clay in the subsoil than the Hagerstown soils.

Typical pedon of the Duffield silt loam, 0 to 3 percent slopes, in cornfield 4.5 miles southwest of Lebanon, on Pennsylvania Route 241:

- Ap—0 to 11 inches; dark brown (10YR 4/3) silt loam; strong coarse and medium granular structure; friable, nonsticky and slightly plastic; 5 percent coarse fragments; neutral; abrupt smooth boundary.
- B1—11 to 14 inches; yellowish brown (10YR 5/6) light silt loam; weak coarse subangular blocky structure; friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.
- B21t—14 to 46 inches; yellowish brown (10YR 5/6) silty clay loam; weak coarse subangular blocky structure parting to medium subangular blocky; firm, slightly sticky and slightly plastic; many thin clay films on ped interiors and in pores; common black oxide coatings on ped faces; 5 percent coarse fragments; neutral; clear wavy boundary.
- B22t—46 to 51 inches; yellowish brown (10YR 5/8) silty clay loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; many thin clay films on ped interiors and in pores; 5 percent coarse fragments, neutral; clear wavy boundary.
- B23t—51 to 61 inches; yellowish brown (10YR 5/8) loam; weak coarse subangular blocky structure; slightly firm slightly sticky and slightly plastic; very few thin clay films on ped interiors; few black oxide coatings on ped faces; 5 percent coarse fragments; slightly acid; clear wavy boundary.

C—61 to 70 inches; light olive brown (2.5Y 5/4) loam; weak coarse subangular blocky structure; friable, slightly sticky and slightly plastic; thin clay films in pores; 5 percent coarse fragments; slightly acid.

The solum ranges from 40 to 70 inches in thickness. Depth to bedrock ranges from 4 to 10 feet. Content of coarse fragments ranges from 0 to 5 percent in the A horizon, 5 to 20 percent in the B horizon, and 5 to 30 percent in the C horizon. Reaction is strongly acid to neutral above a depth of 50 inches and strongly acid to slightly acid below that depth.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) to dark brown (10YR 4/3).

The B horizon ranges from brownish yellow (10YR 6/8) to brown (7.5YR 4/4). The fine earth fraction ranges from loam to silty clay loam.

The C horizon ranges from yellowish red (5YR 4/6 to 5/8) to light olive brown (2.5Y 5/4). The fine earth fraction ranges from loam to silty clay loam.

### Hagerstown series

The Hagerstown series consists of fine, mixed, mesic, Typic Hapludalfs. These deep, well drained soils are on undulating uplands. They have a dark yellowish brown silt loam Ap horizon, a strong brown silty clay loam B1 horizon, and a yellowish red and strong brown silty clay and silty clay loam Bt horizon.

The principal associated soils are the deep, well drained Duffield and Nolin Variant soils; the deep, moderately well drained Clarksburg soils; and the deep, poorly drained Thorndale and Melvin Variant soils.

Typical pedon of Hagerstown silt loam, 3 to 8 percent slopes, in a cornfield 3 miles west of Lebanon, along Township Route 421:

- Ap—0 to 8 inches; dark yellowish brown (10YR 3/4) silt loam; weak very fine and fine granular structure; friable, slightly sticky and slightly plastic; neutral; abrupt wavy boundary.
- B1—8 to 13 inches; strong brown (7.5YR 5/6) silty clay loam; moderate fine subangular blocky structure; friable, sticky and plastic; few thin patchy clay films; neutral; gradual wavy boundary.
- B21t—13 to 21 inches; yellowish red (5YR 4/6) silty clay; moderate fine subangular blocky structure; friable, sticky and plastic; few thin clay films on root channels; 2 percent coarse fragments; neutral; diffuse boundary.
- B22t—21 to 30 inches; yellowish red (5YR 4/6) silty clay; weak medium subangular blocky structure; friable, sticky and plastic; thick clay films in root channels; 2 percent coarse fragments; neutral; diffuse boundary.
- B23t—30 to 40 inches; yellowish red (5YR 5/6) silty clay; weak medium subangular blocky structure; fri-

able, sticky and plastic; thick clay films in root channels; neutral; clear wavy boundary.

B24t—40 to 45 inches; strong brown (7.5YR 5/6) silty clay loam; weak fine subangular blocky structure; friable, sticky and plastic; thick patchy clay films on ped faces; neutral; clear wavy boundary.

B25t—45 to 60 inches; yellowish red (5YR 5/6) silty clay loam; weak fine subangular blocky structure; friable, sticky and plastic; thick patchy clay films on ped surfaces; slightly acid.

The solum ranges from 40 to 72 inches in thickness. Depth to bedrock ranges from 3-1/2 to 7 feet or more. Content of coarse fragments is less than 15 percent by volume. Reaction in unlimed areas is very strongly or strongly acid in the upper part of the solum and strongly acid to neutral in the lower part.

The Ap horizon ranges from dark yellowish brown (10YR 4/4) to dark brown (7.5YR 5/4).

The B1 horizon ranges from strong brown (7.5YR 5/6) to reddish brown (5YR 4/4). The fine earth fraction ranges from heavy loam to silty clay loam. The Bt horizon ranges from strong brown (7.5YR 5/6) to yellowish red (5YR 4/6). Texture is silty clay loam or clay.

## Hazleton series

The Hazleton series consists of loamy-skeletal, mixed, mesic Typic Dystrachrepts. These deep, well drained soils are on convex lower side slopes of valleys and middle and upper side slopes of mountain ridges. They have a very dark grayish brown and grayish brown sandy loam A horizon and a dark brown and strong brown channery and very channery loam B horizon over a strong brown very channery loam C horizon.

The principal associated soils are the deep, well drained Laidig and Leck Kill soils and the moderately deep, well drained Calvin soils. Laidig soils have a fragipan; Leck Kill soils have red hues.

Typical pedon of Hazleton sandy loam, within an area of Hazleton-Laidig association, moderately steep, in woodland, 4 miles north of Lickdale on Legislative Route 38022:

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) sandy loam; weak fine granular structure; friable, nonsticky and nonplastic; many small roots; 5 percent coarse fragments; strongly acid; abrupt smooth boundary.

A2—3 to 7 inches; grayish brown (10YR 5/2) sandy loam; weak fine granular structure; friable, nonsticky and nonplastic; many small roots; 5 percent coarse fragments; strongly acid; clear wavy boundary.

B21—7 to 14 inches; dark brown (7.5YR 4/4) channery loam; weak coarse subangular blocky structure; friable, slightly sticky and slightly plastic; few thin

roots; 30 percent coarse fragments; strongly acid; clear wavy boundary.

B22—14 to 23 inches; strong brown (7.5YR 5/6) channery loam; weak coarse subangular blocky structure; friable, slightly sticky and slightly plastic; few thin roots; 35 percent coarse fragments; strongly acid; clear wavy boundary.

B23—23 to 34 inches; strong brown (7.5YR 5/8) very channery loam; weak coarse subangular blocky structure; friable, slightly sticky and slightly plastic; few thin patchy clay films on ped faces; few thin roots; few black coatings on coarse fragments; 60 percent coarse fragments; strongly acid; clear wavy boundary.

C—34 to 63 inches; strong brown (7.5YR 5/6) very channery loam; massive; friable, slightly sticky and slightly plastic; few thin patchy clay films and few black coatings on coarse fragments; 80 percent coarse fragments; strongly acid.

Solum thickness ranges from 25 to 50 inches. Depth to bedrock is 40 to 72 or more inches. Content of coarse fragments ranges from 5 to 70 percent in individual horizons of the solum and from 35 to 80 percent in the C horizon. In unlimed areas, the reaction is strongly acid to extremely acid.

The A horizon ranges very dark grayish brown (10YR 3/2) to brown (10YR 5/3).

The B horizon ranges from dark brown (7.5YR 4/4) to reddish yellow (7.5YR 6/8). The fine earth fraction is loam or sandy loam.

The C horizon ranges from yellowish red to yellowish brown (10YR 5/8). Texture ranges from loam to loamy sand in the fine earth fraction.

## Holly series

The Holly series consists of fine-loamy, mixed, nonacid, mesic Typic Fluvaquents. These deep, very poorly drained and poorly drained soils are on flood plains. They have a dark grayish brown silt loam and gray light silty clay loam B horizon; and a mottled gray loamy sand IIC horizon.

The principal associated soils are the deep, well drained Pope soils and the moderately well drained Philo soils on flood plains and the poorly drained Brinkerton soils on uplands.

Typical pedon of Holly silt loam, in pasture on a flood plain, one-quarter mile west of Freeport Mills:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; strong medium granular structure; friable, nonsticky and slightly plastic; many fine roots; neutral; clear wavy boundary.

B21g—7 to 17 inches; dark grayish brown (10YR 4/2) silt loam; many medium distinct grayish brown (2.5Y 5/2) and yellowish red (5YR 4/6) mottles; weak

medium platy structure parting weak fine subangular blocky; friable, slightly sticky and slightly plastic; many fine roots; slightly acid; clear wavy boundary.

B22g—17 to 20 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct yellowish red (5YR 4/6) mottles; weak coarse subangular blocky structure; friable, nonsticky and nonplastic; common black oxide coatings on ped interiors; slightly acid; clear wavy boundary.

B23g—20 to 26 inches; grayish brown (10YR 5/2) silt loam; common medium faint and distinct yellowish brown (10YR 5/6) and yellowish red (5YR 5/8) mottles; weak medium platy structure parting to weak fine subangular blocky; friable, slightly sticky and slightly plastic; thin continuous silt films lining pores; neutral; clear wavy boundary.

B24g—26 to 40 inches; gray (5Y 5/1) light silty clay loam; many prominent yellowish red (5YR 4/6) mottles; weak coarse subangular blocky structure; very friable, sticky and plastic; neutral; clear wavy boundary.

lICg—40 to 60 inches; gray (5Y 5/1) loamy sand; common prominent strong brown mottles; single grain; loose, nonsticky and nonplastic; neutral.

The solum ranges from 24 to 44 inches in thickness. Depth to bedrock ranges from 4 to 20 feet. Content of coarse fragments in the control section ranges from 0 to 15 percent. In unlimed areas, reaction is strongly acid to neutral in the control section.

The Ap horizon is dark grayish brown (10YR 4/2) or dark gray (10YR 4/1).

The B horizon ranges from gray (10YR 5/1 and 5Y 5/1) to light brownish gray (10YR 6/2). Texture ranges from silt loam to light silty clay loam.

The lIC horizon ranges from dark grayish brown (2.5Y 5/1) to gray (5Y 5/1). The fine earth fraction ranges from loam to stratified layers of sand and gravel.

### Klinesville series

The Klinesville series consists of loamy-skeletal, mixed, mesic Lithic Dystrochrepts. These shallow, well drained soils are on rounded, convex side slopes of dissected uplands. They have a dark reddish brown shaly silt loam Ap horizon, a reddish brown very shaly silt loam B horizon, and a weak red very shaly silt loam C horizon over dusky red, highly shattered shale bedrock.

The principal associated soils are the deep, well drained Bucks and Leck Kill soils and the moderately deep, well drained Berks, Calvin, and Penn soils.

Typical pedon of Klinesville shaly silt loam, 3 to 8 percent slopes, in pasture one-half mile west of Fredericksburg and 50 feet north along Township Route 486 on east side of road:

Ap—0 to 6 inches; dark reddish brown (2.5YR 3/4) shaly silt loam; strong very fine and fine granular structure; friable, slightly sticky and nonplastic; 25 percent coarse fragments; slightly acid; clear wavy boundary.

B—6 to 10 inches; reddish brown (2.5YR 4/4) very shaly silt loam; weak fine subangular blocky structure; friable, slightly sticky and slightly plastic; 60 percent coarse fragments; medium acid; clear wavy boundary.

C—10 to 14 inches; weak red (10YR 4/4) very shaly silt loam; massive; 80 percent coarse fragments; strongly acid; clear wavy boundary.

R—14 inches; highly fractured or shattered, undisplaced, dusky red (10R 3/3) shale bedrock in nearly vertical plane.

Depth to bedrock and solum thickness range from 10 to 20 inches. Content of coarse fragments ranges from 15 to 75 percent by volume in individual horizons in the solum and from 45 to 90 percent in the C horizon. In unlimed areas the reaction ranges from very strongly acid to medium acid throughout.

The Ap horizon ranges from dark reddish gray (5YR 4/2) to dark reddish brown (2.5YR 3/4).

The B horizon ranges from red (10YR 4/6) to reddish brown (2.5YR 4/4).

The C horizon ranges from red (10YR 4/6) to dark reddish brown (2.5YR 3/4).

### Laidig series

The Laidig series consists of fine-loamy, mixed, mesic, Typic Fragiuudults. These deep, well drained soils are on convex foot slopes, side slopes, and tops of ridges on uplands. They have a very dark grayish brown and grayish brown channery loam A horizon and strong brown channery heavy loam Bt horizon over a firm and brittle yellowish red channery sandy clay loam Bx horizon.

The principal associated soils are the deep, well drained Leck Kill and Hazleton soils and the moderately deep, well drained Berks and Calvin soils. Laidig soils have a fragipan; Leck Kill and Hazleton soils do not.

Typical pedon of Laidig channery loam, in an area of Laidig extremely stony loam, 8 to 25 percent slopes, in woods and borrow pit, three-fifths mile north of Pennsylvania Route 443 from junction U.S. Route 72, Edward Martin Military Reservation:

O1—2 inches to 1 inch; undecomposed oak and pine leaf and twig litter.

O2—1 inch to 0; black (10YR 2/1) organic mat held together by roots and mycelium; 25 percent stone cover.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) channery loam; weak fine granular structure; friable, nonsticky and slightly plastic; many fine roots; 25

percent coarse fragments; extremely acid; abrupt smooth boundary.

A2—3 to 7 inches; grayish brown (10YR 5/2) channery loam; weak fine subangular blocky structure; friable, nonsticky and slightly plastic; many fine roots; 25 percent coarse fragments; very strongly acid; clear wavy boundary.

B1—7 to 15 inches; yellowish brown (10YR 5/6) channery loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; few fine roots; 30 percent coarse fragments; very strongly acid; gradual wavy boundary.

B21t—15 to 22 inches; strong brown (7.5YR 5/6) channery heavy loam; weak medium subangular blocky structure parting to weak fine subangular blocky; friable, slightly sticky and slightly plastic; common thin continuous clay films in pores and ped interiors; 15 percent coarse fragments; very strongly acid; gradual wavy boundary.

B22t—22 to 31 inches; strong brown (7.5YR 5/6) channery heavy loam; weak coarse prismatic structure parting to weak medium subangular blocky; firm, sticky and plastic; common thick continuous clay films on prism faces and in pores; few black oxide coatings on peds; 15 percent coarse fragments; extremely acid; gradual wavy boundary.

Bx1—31 to 59 inches; yellowish red (5YR 4/8) channery sandy clay loam; many medium faint light reddish brown (5YR 6/4) mottles; weak very coarse prismatic structure parting to weak medium subangular blocky; firm and brittle, sticky and plastic; thick patchy clay films in pores and ped interiors; few black oxide coatings on peds; 35 percent coarse fragments; very strongly acid; gradual wavy boundary.

Bx2—59 to 80 inches; yellowish red (5YR 5/6) channery sandy clay loam; many medium faint yellowish brown (10YR 5/6) mottles; weak very coarse prismatic structure parting to weak medium subangular blocky; firm and brittle, sticky and plastic; thick patchy clay films on prism faces; few black oxide coatings on peds; 40 percent coarse fragments; very strongly acid.

The solum thickness ranges from 60 to 80 inches or more. Bedrock is more than 5 feet deep. Depth to the fragipan ranges from 30 to 50 inches. Content of coarse fragments ranges between 15 and 35 percent by volume in the textural control section and from 15 to 70 percent in individual subhorizons of the Bx horizon. Where unlimed, reaction is strongly acid to extremely acid throughout the solum.

The A horizon ranges from very dark grayish brown (10YR 3/2) to yellowish brown (10YR 5/4).

The B horizon above the fragipan is strong brown (7.5YR 5/6) or yellowish brown (10YR 5/4 or 5/6). It has mottles with chromas of 3 or higher below a depth of 30

inches in some places. Texture ranges from silt loam to sandy clay loam in the fine earth fraction. The Bx horizon ranges from reddish brown (5YR 4/4 to 5/4) to yellowish red (5YR 5/8), with some mottles. Texture ranges from heavy loam to sandy clay loam in the fine earth fraction.

### Leck Kill series

The Leck Kill series consists of fine-loamy, mixed, mesic Typic Hapludults. These deep, well drained soils are on convex, dissected foot slopes and side slopes of uplands. They have a dark reddish brown shaly silt loam A horizon, a reddish brown shaly silty clay loam Bt horizon, and a reddish brown very shaly silt loam C horizon over dusky red, interbedded shale, siltstone, and sandstone bedrock.

The principal associated soils are the shallow, well drained Klinesville soils and the moderately deep, well drained Calvin soils.

Typical pedon of Leck Kill shaly silt loam, 8 to 15 percent slopes, one-half mile north of Baseshores Lake and Pennsylvania Route 443:

O1—1-1/2 to 1 inch; mosses and leaf and twig litter.

O2—1 inch to 0; black (5YR 3/1) organic mat; extremely acid; abrupt smooth boundary.

A1—0 to 12 inches; dark reddish brown (5YR 3/4) shaly silt loam; weak medium granular structure; friable, slightly sticky and slightly plastic; 20 percent coarse fragments; very strongly acid; abrupt wavy boundary.

B21t—12 to 26 inches; reddish brown (2.5YR 4/4) shaly silty clay loam; moderate medium subangular blocky structure parting to weak fine subangular blocky; friable, sticky and plastic; few thin patchy clay films on peds and in pores; 30 percent coarse fragments; very strongly acid; clear wavy boundary.

B22t—26 to 48 inches; reddish brown (2.5YR 4/4) shaly silt clay loam; moderate medium subangular blocky structure parting to weak fine subangular blocky; friable, sticky and plastic; common thin patchy clay films on peds and in pores; 40 percent coarse fragments; very strongly acid; clear wavy boundary.

C—48 to 70 inches; reddish brown (5YR 5/4) very shaly silt loam; massive; friable, slightly sticky and slightly plastic; 85 percent coarse fragments; very strongly acid; clear wavy boundary.

R—70 inches; dusky red (10YR 3/3) interbedded shale, siltstone, and sandstone.

The solum thickness ranges from 24 to 48 inches. Depth to bedrock is 3-1/2 feet to 6 feet. Content of coarse fragments ranges from 5 to 25 percent in the A horizon and B1 horizon if present; from 10 to 40 percent in the Bt horizon; from 35 to 65 percent in the B3 horizon if present; and from 60 to 90 percent in the C horizon. In unlimed areas, reaction is very strongly acid or strongly acid in the solum.

The A horizon ranges from dark reddish brown (5YR 3/4) to reddish brown (2.5YR 4/4).

The B horizon ranges from reddish brown (2.5YR 5/4) to red (10YR 4/6). Texture ranges from silty clay loam to clay loam in the fine earth fraction.

The C horizon ranges from reddish brown (5YR 5/4) to weak red (10YR 4/4). The fine earth fraction ranges from silt loam to clay loam.

### Lehigh series

The Lehigh series consists of fine-loamy, mixed, mesic Aquic Hapludalfs. These deep, moderately well drained and somewhat poorly drained soils are on lower foot slopes in the uplands. They have a dark grayish brown silt loam Ap horizon; a dark brown, dark grayish brown, and dark gray channery silt loam and channery silty clay loam Bt horizon; and a dark grayish brown, mottled, very channery silt loam C horizon over porcelanite bedrock.

The principal associated soils are the deep, well drained Breckneck and Neshaminy soils and the deep, poorly drained Watchung soils.

Typical pedon of Lehigh silt loam, 2 to 10 percent slopes, in cultivated field, 1 mile south of Mt. Gretna on west side of Legislative Route 38061. Then five-eighths mile west of Pennsylvania Game Lands parking area:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable, nonsticky and nonplastic; 10 percent coarse fragments; strongly acid; abrupt smooth boundary.

B21t—7 to 14 inches; dark brown (10YR 4/3) channery silt loam; moderate fine subangular blocky structure; friable, slightly sticky and nonplastic; thin patches of clay films on ped faces and in pores; 20 percent coarse fragments; strongly acid; clear wavy boundary.

B22t—14 to 21 inches; dark grayish brown (10YR 4/2) channery silty clay loam; common medium faint dark yellowish brown (10YR 4/4) and grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; thin clay films on ped faces; 25 percent coarse fragments; strongly acid; gradual wavy boundary.

B23t—21 to 28 inches; dark gray (10YR 4/1) channery silt loam; common fine distinct olive brown (2.5 4/4) mottles; moderate medium subangular blocky structure; firm, slightly sticky and slightly plastic; few patches of clay films on ped faces; 35 percent coarse fragments; strongly acid; gradual wavy boundary.

C—28 to 42 inches; dark grayish brown (10YR 4/2) very channery silt loam; few fine distinct olive brown (2.5Y 4/4) mottles; weak medium subangular blocky structure; firm, slightly sticky and nonplastic; 80 per-

cent coarse fragments; strongly acid; abrupt wavy boundary.

R—42 inches; very dark gray (10YR 3/1) to dark bluish gray (5B 4/1) porcelanite.

The solum thickness ranges from 20 to 40 inches. Depth to bedrock is 3-1/2 to 5 feet. Content of coarse fragments ranges from 5 to 40 percent in the solum and 40 to 90 percent in the C horizon. In unlimed areas the soil is medium acid to strongly acid.

The Ap horizon ranges from dark gray (10YR 4/1) to dark brown (10YR 4/3).

The Bt horizon ranges from dark gray (10YR 4/1) to dark brown (10YR 4/3). Texture ranges from silt loam to silty clay loam in the fine earth fraction. Light brownish gray, yellowish brown, or yellowish red mottles range from 10 inches to 18 inches below the surface.

The C horizon ranges from dark gray (5Y 4/1) to dark brown (10YR 4/3). Texture is silt loam or silty clay loam in the fine earth fraction.

### Lindside series

The Lindside series consists of fine-silty, mixed, mesic Fluvaquentic Euthrochrepts. These moderately well drained soils are on flood plains. They have a brown silt loam Ap horizon; a mottled, dark brown silt loam B horizon; and a mottled, dark grayish brown, stratified fine sandy loam and silt loam C horizon.

The principal associated soils are the moderately well drained Clarksburg soils, the well drained Duffield and Hagerstown soils, and the poorly drained Thorndale soils on uplands. All these soils have an argillic horizon. In addition, Clarksburg and Thorndale soils have a fragipan. Melvin Variant is a poorly drained soil on associated flood plains. It formed in material similar to Lindside soils.

Typical pedon of Lindside silt loam, along Snitz Creek, southeast of Cleona:

Ap—0 to 8 inches; brown (10YR 5/3) silt loam; weak fine granular structure; friable, and nonsticky and nonplastic; slightly acid; clear smooth boundary.

B21—8 to 17 inches; dark brown (7.5YR 4/4) silt loam; weak fine subangular blocky structure; friable, nonsticky and nonplastic; slightly acid; gradual wavy boundary.

B22—17 to 27 inches; dark brown (10YR 4/3) silt loam; few medium faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable, slightly sticky and nonplastic; slightly acid; gradual wavy boundary.

B23—27 to 32 inches; dark brown (7.5YR 4/4) silt loam; many medium distinct dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; friable, slightly sticky and nonplastic; 5 percent

coarse fragments; slightly acid; abrupt wavy boundary.

B24—32 to 42 inches; dark brown (7.5YR 4/4) silt loam; common medium distinct light brownish gray (10YR 6/2) and faint strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable, slightly sticky and nonplastic; 5 percent coarse fragments; slightly acid gradual wavy boundary.

C—42 to 60 inches; dark grayish brown (10YR 4/2) stratified fine sandy loam and silt loam; common medium distinct grayish brown (2.5Y 5/2) mottles; massive; very friable, nonsticky and nonplastic; medium acid.

The solum thickness ranges from 25 to 50 inches. Depth to low-chroma mottles ranges from 14 to 24 inches. Content of coarse fragments ranges from 0 to 5 percent. In unlimed areas, reaction ranges from strongly acid to slightly acid in the upper part of the solum and medium acid to neutral in the lower part.

The Ap horizon ranges from dark brown (10YR 4/3) to brown (7.5YR 5/2).

The B horizon ranges from brown (7.5YR 5/4) to dark brown (10YR 4/3). The fine earth fraction ranges from silt loam and very fine sandy loam to light silty clay loam.

The C horizon ranges from dark brown (7.5YR 4/2) to yellowish brown (10YR 5/4). It is stratified fine sandy loam, loam, silt loam, and silty clay loam.

## Markes series

The Markes series consists of loamy-skeletal, mixed, mesic Typic Ochraqualfs. These moderately deep, poorly drained soils are on upland flats and foot slopes. They have a dark grayish brown silt loam Ap horizon; a light olive gray and grayish brown, mottled, shaly silty clay loam and very shaly silty clay loam Bt horizon; and a light olive gray very shaly silty clay loam C horizon over fractured acid shale.

The principal associated soils are Brinkerton and Comly soils, which have a fragipan. In addition, Comly soils are better drained than the Markes soils.

Typical pedon of Markes silt loam, 0 to 5 percent slopes, in an idle field, about 1 mile north along Township Route 470 from junction with Legislative Route 38049:

Ap—0 to 7 inches; dark grayish brown (2.5Y 4/2) silt loam; weak fine granular structure; friable, slightly sticky and slightly plastic; many roots; 5 percent coarse fragments; strongly acid; abrupt smooth boundary.

B21tg—7 to 15 inches; light olive gray (5Y 6/2) shaly silty clay loam; many medium prominent yellowish brown (10YR 5/8) and strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; firm, sticky and slightly plastic; thick patches of

grayish brown (2.5Y 5/2) clay films on ped faces; 50 percent coarse fragments; strongly acid; clear wavy boundary.

B22tg—15 to 22 inches; grayish brown (2.5Y 5/2) very shaly silty clay loam; many medium prominent yellowish brown (10YR 5/6) and light gray (10YR N7/ ) mottles; moderate medium angular blocky structure; firm, sticky and slightly plastic; thick patches of light brownish gray (2.5Y 6/2) clay films on ped faces; 60 percent coarse fragments; very strongly acid; gradual wavy boundary.

C—22 to 31 inches; light olive gray (5Y 6/2) very shaly silty clay loam; many prominent reddish yellow (7.5YR 6/8), yellow (10YR 7/6), and faint light gray (5Y 7/2) mottles; massive; firm, slightly sticky and nonplastic; 85 percent coarse fragments; strongly acid; clear irregular boundary.

R—31 inches; dark grayish brown (5Y 4/2) fractured acid shale.

The solum thickness ranges from 18 to 36 inches. Depth to bedrock ranges from 20 to 40 inches. Coarse fragments make up 5 to 25 percent of the A horizon, 35 to 80 percent of the B horizon, and 60 to 85 percent of the C horizon. In cultivated areas, reaction ranges from strongly acid to neutral in the Ap horizon, from very strongly acid to medium acid in the B horizon, and from strongly acid to slightly acid in the C horizon.

The Ap horizon ranges from dark grayish brown (10YR 4/2) to olive (5Y 5/3).

The Bt horizon ranges from dark gray (10YR 4/1 and N4/ ) to light olive gray (5Y 6/2) and has mottles of high and low chroma. Texture ranges from silty clay loam to loam in the fine earth fraction.

The C horizon commonly has colors and textures similar to those of the B horizon.

## Melvin Variant

The Melvin Variant consists of fine-loamy, mixed, non-acid, mesic Typic Fluvaquents. These deep, poorly drained soils are on flood plains. They have a dark grayish brown silt loam Ap horizon, an olive gray and dark gray silt loam B2 horizon, and an olive gray gravelly loam C horizon.

The principal associated soils are the moderately well drained Clarksburg soils, the well drained Duffield and Murrill soils, and the poorly drained Thorndale soils.

Typical pedon of Melvin Variant silt loam, in pasture on a flood plain one-quarter mile south of Stricklertown:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; common fine distinct dark brown (7.5YR 4/4) mottles; weak fine granular structure; friable, slightly sticky and slightly plastic; many fine roots; neutral; abrupt smooth boundary.



B21g—9 to 22 inches; olive gray (5Y 4/2) silt loam; common medium prominent dark brown (7.5YR 4/4) mottles; weak fine subangular blocky structure; friable, slightly sticky and slightly plastic; few fine roots; neutral; gradual smooth boundary.

B22g—22 to 25 inches; dark gray (5Y 4/1) silt loam; common medium prominent yellowish red (5YR 4/6) mottles; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; neutral; gradual smooth boundary.

Cg—25 to 60 inches; olive gray (5Y 5/2) gravelly loam; common medium prominent yellowish red (5YR 5/6) mottles; massive; friable, nonsticky and nonplastic; 20 percent gravel; neutral.

The solum ranges from 18 to 40 inches in thickness. Depth to bedrock is 4 to 20 feet or more. Content of coarse fragments ranges from 0 to 5 percent in the solum and 10 to 20 percent in the C horizon. In unlimed areas, reaction ranges from slightly acid to neutral throughout.

The Ap horizon ranges from brown (10YR 4/3) through olive gray (5Y 5/2).

The B horizon ranges from light gray (10YR 7/2) through dark gray (5Y 4/1). Texture is silt loam or silty clay loam in the fine earth fraction.

The C horizon commonly has colors like those in the B horizon. Texture ranges from light silty clay loam to loam in the fine earth fraction.

## Mount Lucas series

The Mount Lucas series consists of fine-loamy, mixed, mesic Aquic Hapludalfs. These deep, moderately well drained and somewhat poorly drained soils are on upland flats and concave lower foot slopes. They have a dark brown silt loam Ap horizon; a yellowish brown silt loam B1 horizon; a mottled, brown channery silty clay loam Bt horizon; and a mottled, brown very channery silt loam C horizon.

The principal associated soils are the well drained Neshaminy and poorly drained Watchung soils.

Typical pedon of Mount Lucas silt loam, 3 to 8 percent slopes, in cultivated field two-fifths of a mile south of Colebrook:

Ap—0 to 10 inches; dark brown (7.5YR 4/4) silt loam; moderate medium subangular blocky structure parting to medium granular; friable; nonsticky and nonplastic; neutral; abrupt smooth boundary.

B1—10 to 15 inches; yellowish brown (10YR 5/4) silt loam; weak medium platy structure parting to fine granular; friable, slightly sticky and slightly plastic; few thin clay films lining pores; neutral; clear wavy boundary.

B21t—15 to 21 inches; brown (7.5YR 5/4) channery silty clay loam; few fine distinct grayish brown (10YR

5/2) and yellowish red (5YR 5/8) mottles; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; common thin patches of clay films on ped faces and discontinuous in pores; 15 percent coarse fragments; slightly acid; gradual wavy boundary.

B22t—21 to 35 inches; brown (7.5YR 5/4) channery silty clay loam; common medium and coarse distinct yellowish red (5YR 5/6) and grayish brown (2.5Y 5/2) mottles; moderate medium subangular blocky structure; slightly firm, sticky and plastic; common thick clay films on ped faces and in pores; 30 percent coarse fragments; slightly acid; gradual wavy boundary.

C—35 to 60 inches; brown (10YR 4/3) very channery silt loam; common distinct grayish brown (2.5Y 5/2) mottles; massive; friable, sticky and plastic; common thick patches of clay films on ped faces; 60 percent coarse fragments; slightly acid.

The solum ranges from 25 to 50 inches in thickness. Depth to bedrock ranges from 4 to 15 feet. Depth to mottles with chromas of 2 or less ranges from 15 to 28 inches. Content of coarse fragments ranges from 0 to 30 percent in the solum and from 20 to 60 percent in the C horizon. In unlimed areas, reaction ranges from strongly acid to slightly acid in the upper part of the solum and from medium acid to neutral in the lower part.

The Ap horizon ranges from brown (7.5YR 5/4) to dark grayish brown (10YR 4/2).

The Bt horizon ranges from brown (10YR 5/3) to reddish yellow (5YR 6/6). The fine earth fraction is dominantly silty clay loam and sandy clay loam.

The C horizon ranges from strong brown (7.5YR 5/6) to brown (10YR 4/3) with grayish brown and strong brown mottles. The fine earth fraction ranges from silt loam to loamy coarse sand. Depth to loamy sand is more than 40 inches.

## Murrill series

The Murrill series consists of fine-loamy, mixed, mesic Typic Hapludults. These deep, well drained soils are on upland colluvial foot slopes, fans, and benches. They have a dark brown gravelly silt loam Ap horizon; a yellowish brown and strong brown channery silty clay loam, channery clay loam, and channery sandy clay loam Bt horizon; and a mottled strong brown and reddish brown clay loam IIB horizon.

The principal associated soils are Buchanan, Chester, and Duffield. Buchanan soils have mottles in the B horizon and have a fragipan. Chester soils formed in material weathered from granitized schist and gneiss. Duffield soils have more than 35 percent base saturation and do not have a IIB horizon.

Typical pedon of Murrill gravelly silt loam, 3 to 8 percent slopes, one-half mile northeast of Stricklerstown, then east along farm lane to high-power lines:

- Ap—0 to 10 inches; dark brown (10YR 4/3) gravelly silt loam; weak fine granular structure; friable, slightly sticky and slightly plastic; 15 percent coarse fragments; medium acid; abrupt smooth boundary.
- B21t—10 to 21 inches; yellowish brown (10YR 5/6) channery silty clay loam; moderate medium subangular blocky structure; friable, slightly sticky and plastic; thin patches of clay films on ped faces and lining pores; 20 percent coarse fragments; strongly acid; clear wavy boundary.
- B22t—21 to 36 inches; strong brown (7.5YR 5/6) channery clay loam; moderate medium subangular blocky structure; friable, slightly sticky and plastic; thin patches of clay films on ped faces and lining pores; 30 percent coarse fragments; strongly acid; gradual wavy boundary.
- B23t—36 to 56 inches; yellowish brown (10YR 5/6) channery sandy clay loam; moderate medium platy structure parting to weak very fine subangular blocky; firm, slightly sticky and plastic; thin patches of clay films on ped faces and lining pores; few black stains on ped faces; 30 percent coarse fragments; strongly acid; gradual wavy boundary.
- 11B3—56 to 62 inches; strong brown (7.5YR 5/8) and reddish brown (5YR 4/4) clay loam; common fine distinct brownish yellow (10YR 6/6) and yellowish red (5YR 5/8) mottles; strong medium subangular blocky structure; firm, slightly sticky and plastic; many black coats on pressure faces; strongly acid.

The solum is more than 6 feet thick, and depth to the 11B horizon ranges from 36 to 65 inches. Depth to bedrock is more than 6 feet. Content of coarse fragments ranges from 10 to 30 percent in the upper part of the solum and from 0 to 40 percent in the 11B horizon. In unlimed areas, reaction ranges from medium acid to very strongly acid.

The Ap horizon ranges from dark yellowish brown (10YR 4/4) to very dark grayish brown (10YR 3/2). Dry color values are 6 or more.

The Bt horizon ranges from brownish yellow (10YR 6/6) to dark reddish brown (5YR 4/4). The fine earth fraction ranges from silty clay loam to sandy clay loam. Colors in the 11B horizon are commonly similar to those in the Bt horizon but may be mixed in hues of 2.5YR through 10YR, commonly with mottles. The fine earth fraction ranges from clay loam to clay. Pressure faces with black coatings are common.

### Neshaminy series

The Neshaminy series consists of fine-loamy, mixed, mesic Ultic Hapludalfs. These deep, well drained soils

are on convex sides and tops of ridges. They have a dark brown gravelly silt loam Ap horizon, a yellowish red clay loam and red gravelly loam Bt horizon, and a strong brown gravelly sandy clay loam C horizon.

The principal associated soils are the moderately well drained and somewhat poorly drained Mount Lucas soils, the moderately well drained to somewhat poorly drained Lehigh soils, and the poorly drained Watchung soils.

Typical pedon of Neshaminy gravelly silt loam, 3 to 8 percent slopes, in woodland clearing 2 miles west of Colebrook:

- Ap—0 to 9 inches; dark brown (7.5YR 4/3) gravelly silt loam; moderate medium and fine granular structure; friable, slightly sticky and slightly plastic; many grass roots; 15 percent coarse fragments; neutral; abrupt smooth boundary.
- B21t—9 to 21 inches; yellowish red (5YR 4/8) clay loam; moderate coarse subangular blocky structure; firm, slightly sticky and plastic; thin clay films on ped interiors and in pores; few grass roots; 5 percent coarse fragments; neutral; gradual smooth boundary.
- B22t—21 to 30 inches; yellowish red (5YR 4/8) clay loam; moderate coarse subangular blocky structure; firm, slightly sticky and plastic; thick clay films on ped interiors and lining pores; many black oxide coatings on ped interiors; few grass roots; 5 percent coarse fragments; medium acid; clear wavy boundary.
- B23t—30 to 44 inches; red (2.5YR 4/4) gravelly loam; moderate coarse subangular blocky structure; firm, slightly sticky and plastic; thick clay films on ped interiors and lining pores; many black oxide coatings on ped interiors; 15 percent coarse fragments; medium acid; clear wavy boundary.
- C—44 to 60 inches; strong brown (7.5YR 5/6) gravelly sandy loam; variegated streaks of light yellowish brown (2.5Y 6/4) and red (2.5YR 4/5); massive; friable, slightly sticky and slightly plastic; thin discontinuous clay films on ped interiors and in pores; 20 percent coarse fragments; strongly acid.

The solum thickness ranges from 40 to 60 inches. Depth to bedrock ranges from 4 to 6 feet. Content of coarse fragments ranges from 5 to 40 percent in the individual horizons of the upper part of the solum and from 15 to 60 percent in the lower part and in the C horizon. In unlimed areas, the soil is medium acid to very strongly acid in the upper part of the solum and strongly acid or medium acid in the lower part and in the C horizon.

The Ap horizon ranges from dark brown (7.5YR 3/2) to dark yellowish brown (10YR 5/4).

The B horizon ranges from strong brown (7.5YR 5/8) to reddish brown (2.5YR 4/4). Part of the B horizon has hue of 5YR or redder. Texture ranges from silt loam to sandy clay loam in the fine earth fraction.

The C horizon ranges from strong brown (7.5YR 5/6) to dark reddish brown (2.5YR 3/4) and is often variegated. Texture ranges from silt loam to sandy loam in the fine earth fraction.

### Nolin Variant

The Nolin Variant consists of coarse-loamy, mixed, mesic Dystric Fluventic Euthrochrepts. These deep, well drained soils are on flood plains and in low areas between higher slopes on uplands. They have a dark brown silt loam Ap horizon, a dark yellowish brown silt loam B horizon, and a dark yellowish brown gravelly fine sandy loam and brown gravelly loam C horizon.

The principal associated soils are the moderately well drained Clarksburg soils, the well drained Duffield and Hagerstown soils on uplands, and the moderately well drained Lindsides soils and the poorly drained Melvin Variant soils on flood plains.

Typical pedon of Nolin Variant silt loam, three-quarters of a mile north of Rexmont on the south side of Pennsylvania Route 419:

- Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam; moderate fine granular structure; very friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.
- B2—10 to 31 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; 5 percent coarse fragments; neutral; abrupt wavy boundary.
- C1—31 to 35 inches; dark yellowish brown (10YR 4/4) gravelly fine sandy loam; massive; friable, slightly sticky and nonplastic; few black coatings on peds; 15 percent coarse fragments; neutral; gradual wavy boundary.
- C2—35 to 60 inches; brown (10YR 4/3) gravelly loam; massive; friable, nonsticky and nonplastic; 50 percent coarse fragments; neutral.

The solum thickness ranges from 30 to 50 inches. Content of coarse fragments ranges from 0 to 5 percent in the solum and from 15 to 50 percent in the C horizon. Reaction is medium acid to neutral.

The Ap horizon has hue of 10YR, value of 3 through 5, and chroma of 2 or 3.

The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. Texture is silt loam or light silty clay loam in the fine earth fraction.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 through 4. The fine earth fraction ranges from silt loam to sandy loam and may be stratified.

### Penn series

The Penn series consists of fine-loamy, mixed, mesic Ultic Hapludalfs. These moderately deep, well drained soils are on convex side slopes of moderately dissected uplands. They have a reddish brown shaly silt loam Ap horizon, a dusky red shaly light silty clay loam and shaly silt loam Bt horizon, and a dusky red shaly silt loam C horizon over weak red shale and siltstone bedrock.

The principal associated soils are the shallow, well drained Klinesville soils; the deep, well drained Bucks and Ungers soils; the deep, moderately well drained Readington soils; and the somewhat poorly drained Abbottstown soils.

Typical pedon of Penn shaly silt loam, 3 to 8 percent slopes, in cleared field, 2 miles east of Colebrook on Pennsylvania Route 117:

- Ap—0 to 6 inches; reddish brown (5YR 4/4) shaly silt loam; weak fine granular structure; friable, nonsticky and nonplastic; 15 percent coarse fragments; medium acid; abrupt smooth boundary.
- B1—6 to 11 inches; dark reddish brown (2.5YR 3/4) shaly silt loam; weak medium subangular blocky structure; friable, nonsticky and nonplastic; 20 percent coarse fragments; strongly acid; clear smooth boundary.
- B2t—11 to 22 inches; dusky red (10R 3/4) shaly light silty clay loam; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; many thin clay films on ped faces; 20 percent coarse fragments; strongly acid; clear wavy boundary.
- B3t—22 to 27 inches; dusky red (10YR 3/4) shaly silt loam; weak coarse subangular blocky structure; firm, slightly sticky and slightly plastic; many thin clay films on ped faces; many black coatings on coarse fragments; 30 percent coarse fragments; strongly acid.
- C—27 to 32 inches; dusky red (10YR 3/4) shaly silt loam; massive; firm, nonsticky and slightly plastic; 50 percent coarse fragments; strongly acid.
- R—32 inches; weak red (10YR 4/2) shale and siltstone bedrock.

Solum thickness ranges from 17 to 34 inches. Depth to bedrock ranges from 20 to 40 inches. Content of coarse fragments ranges from 2 to 30 percent in the A horizon, from 10 to 50 percent in the B horizon and from 30 to 70 percent in the C horizon. In unlimed areas, the reaction is extremely acid to strongly acid in the upper part of the solum, and strongly acid or medium acid in the lower part, and strongly acid to slightly acid in the C horizon.

The Ap horizon ranges from dark brown (7.5YR 3/2) to reddish brown (2.5YR 4/4).

The B horizon ranges from dark brown (5YR 3/4) to weak red (10R 4/4). The fine earth fraction is silt loam or light silty clay loam.

The C horizon ranges from weak red (10R 4/4) to dark reddish brown (5YR 3/3). The fine earth fraction is silt loam or loam.

### Philo series

The Philo series consists of coarse-loamy, mixed, mesic Fluvaquentic Dystrochrepts. These deep, moderately well drained soils are on flood plains, commonly along the larger creeks. They have a dark brown silt loam Ap horizon, a strong brown and dark brown silt loam B horizon, and a grayish brown silt loam C horizon.

The principal associated soils are deep, well drained Pope soils and the very poorly drained and poorly drained Holly soils.

Typical pedon of Philo silt loam in cultivated field 2 miles northeast of Valley Glen on south side of Legislative Route 38047:

- Ap—0 to 9 inches; dark brown (10YR 3/3) silt loam; weak coarse subangular blocky structure parting to medium granular; friable, slightly sticky and slightly plastic; many small roots; medium acid; abrupt wavy boundary.
- B21—9 to 24 inches; strong brown (7.5YR 5/6) silt loam; moderate coarse subangular blocky structure parting to medium subangular blocky; friable, slightly sticky and slightly plastic; few thin continuous silt and clay films in pores and root channels; few small roots; slightly acid; clear wavy boundary.
- B2—24 to 39 inches; dark brown (7.5YR 4/4) silt loam; few medium faint grayish brown (10YR 5/2) mottles; black coating on ped interiors; moderate coarse subangular blocky structure; firm, slightly sticky and slightly plastic; few thin continuous silt and clay films lining pores; strongly acid; clear wavy boundary.
- C—39 to 60 inches; grayish brown (10YR 5/2) silt loam; common faint strong brown (7.5YR 5/6) mottles; moderate coarse subangular blocky structure; very friable, slightly sticky and slightly plastic; 10 percent coarse fragments; strongly acid.

Solum thickness ranges from 20 to 48 inches. Depth to low-chroma mottles ranges from 12 to 24 inches. Content of coarse fragments in the textural control section ranges from 0 to 20 percent. Reaction in unlimed areas ranges from very strongly acid to medium acid.

The Ap horizon ranges from dark brown (10YR 3/3) through brown (10YR 4/3).

The B horizon ranges from dark brown (10YR 4/3) through strong brown (7.5YR 5/6). Texture ranges from silt loam to fine sandy loam in the fine earth fraction.

The C horizon ranges from grayish brown (10YR 5/2) through dark gray (N 4/ ) and dark grayish brown (2.5Y

4/2). Texture ranges from silt loam to sandy loam in the fine earth fraction.

### Pope series

The Pope series consists of coarse-loamy, mixed, mesic Fluventic Dystrochrepts. These deep, well drained soils are on flood plains, commonly along the larger creeks. They have a dark yellowish brown loam A horizon; a dark brown and strong brown loam and strong brown gravelly fine sandy loam B horizon; and a strong brown and dark brown loamy sand C horizon.

The principal associated soils are the deep, moderately well drained Philo soils and the very poorly drained and poorly drained Holly soils.

Typical pedon of Pope loam in a woodland 400 feet east of Pennsylvania Route 72, four-fifths mile south of West Jonestown to Swatara Creek:

- A1—0 to 6 inches; dark yellowish brown (10YR 4/4) loam; weak coarse granular structure; very friable, nonsticky and nonplastic; many small roots; strongly acid; clear wavy boundary.
- B1—6 to 9 inches; dark brown (7.5YR 4/4) loam; weak coarse subangular blocky structure; friable, nonsticky and slightly plastic; few roots; very strongly acid; clear wavy boundary.
- B2—9 to 31 inches; strong brown (7.5YR 5/6) loam; weak coarse subangular blocky structure; friable, nonsticky and slightly plastic; few roots; very strongly acid; clear wavy boundary.
- B3—31 to 36 inches; strong brown (7.5YR 5/6) gravelly fine sandy loam; weak coarse subangular blocky structure; friable, nonsticky and slightly plastic; 20 percent gravel; strongly acid; clear wavy boundary.
- IIc1—36 to 47 inches; strong brown (7.5YR 5/6) loamy sand; single grain; very friable, nonsticky and nonplastic; 5 percent gravel; strongly acid; clear wavy boundary.
- IIc2—47 to 62 inches; dark brown (7.5YR 4/4) loamy sand; single grain; very friable, nonsticky and nonplastic; 5 percent gravel; strongly acid.

Thickness of the solum ranges from 30 to 50 inches. Content of coarse fragments ranges from 0 to 30 percent by volume in the solum and from 0 to 40 percent in the C horizon. In unlimed areas, reaction ranges from strongly acid through extremely acid.

The A horizon ranges from dark yellowish brown (10YR 4/4) to grayish brown (10YR 5/2).

The B horizon ranges from dark brown (10YR 4/3) to strong brown (7.5YR 5/6). Texture ranges from sandy loam to silt loam in the fine earth fraction.

The C horizon ranges from dark brown (10YR 4/3) to strong brown (7.5YR 6/6). The fine earth fraction ranges from loamy sand to sandy clay loam or may be stratified in layers of these.

## Readington series

The Readington series consists of fine-loamy, mixed, mesic Typic Fragiudalfs. These deep, moderately well drained soils are on lower hillsides, on upland flats, in drainageways, and at heads of streams. They have a reddish brown silt loam Ap horizon, a reddish brown clay loam Bt horizon, a reddish brown clay loam Bx horizon, and a red gravelly sandy loam IIC horizon.

The principal associated soils are the deep, well drained Bucks and Ungers soils; the moderately deep Penn soils; the deep, moderately well drained to somewhat poorly drained Rowland soils; the deep, somewhat poorly drained Abbottstown soils; the deep, poorly drained and somewhat poorly drained Bowmansville soils; and the deep, poorly drained Brinkerton soils.

Typical pedon of Readington silt loam, 3 to 8 percent slopes, in pasture field, 1.7 miles east of Kleinfeltersville along Pennsylvania Route 897:

- Ap—0 to 12 inches; reddish brown (5YR 4/3) silt loam; strong medium granular structure; friable, nonsticky and slightly plastic; many fine grass roots; neutral; abrupt smooth boundary.
- B1—12 to 17 inches; yellowish red (5YR 5/6) silt loam; weak coarse subangular blocky structure; friable, slightly sticky and slightly plastic; thin clay films on ped interiors; few fine grass roots; neutral; abrupt smooth boundary.
- B21t—17 to 22 inches; reddish brown (5YR 5/4) clay loam; moderate coarse subangular blocky structure; friable, slightly sticky and plastic; thin continuous clay films on ped faces and lining pores; few fine grass roots; neutral; clear wavy boundary.
- B22t—22 to 32 inches; reddish brown (2.5YR 5/4) clay loam; common distinct strong brown (7.5YR 5/8) and pinkish gray (7.5YR 6/2) mottles; moderate coarse subangular blocky structure parting to medium subangular blocky; friable, slightly sticky and plastic; thin continuous clay films on ped faces and lining pores; few fine grass roots; very strongly acid; clear wavy boundary.
- Bx—32 to 45 inches; reddish brown (2.5YR 4/4) clay loam; pinkish gray (7.5YR 6/2) prism crack; moderate very coarse prismatic structure parting to coarse subangular blocky; very firm, slightly sticky and slightly plastic; thick clay films lining pores; 10 percent coarse fragments; strongly acid; clear wavy boundary.
- IIC—45 to 60 inches; red (10YR 4/6) gravelly sandy loam; friable, nonsticky and nonplastic; 15 percent coarse fragments; medium acid.

The solum ranges from 40 to 50 inches in thickness. Depth to bedrock ranges from 40 to 70 inches. Depth to the fragipan ranges from 20 to 36 inches. Content of coarse fragments ranges from 0 to 20 percent in the

upper part of the solum and from 10 to 50 percent in the lower part. Reaction in unlimed areas ranges from extremely acid to strongly acid in the upper part of the solum and strongly acid to slightly acid in the lower part.

The Ap horizon ranges from dark reddish brown (2.5YR 3/4) to reddish brown (5YR 4/3).

The B horizon ranges from yellowish red (5YR 4/6) to reddish brown (2.5YR 5/4). The fine earth fraction ranges from loam through silty clay loam. The Bx horizon ranges from weak red (2.5YR 4/2) to reddish brown (5YR 4/4). Texture is similar to the B horizon.

## Rowland series

The Rowland series consists of fine-loamy, mixed, mesic Fluvaquentic Dystrochrepts. These deep, moderately well drained and somewhat poorly drained soils are on narrow flood plains. They have a reddish brown silt loam Ap horizon and a reddish brown heavy silt loam and sandy clay loam B horizon over a reddish gray sandy loam C horizon and stratified sand and gravel IIC horizon.

The principal associated soils are the deep, somewhat poorly drained Abbottstown soils on uplands; the moderately deep, well drained Penn soils on uplands; the deep, well drained Bucks soils and moderately well drained Readington soils on uplands; and the deep, poorly drained to somewhat poorly drained Bowmansville soils on flood plains.

Typical pedon of Rowland silt loam, west of junction of Pennsylvania Route 241 and Eckert Road, then south to Little Conewago Creek, then approximately 235 feet into pasture:

- Ap—0 to 8 inches; reddish brown (5YR 4/3) silt loam; weak fine granular structure; friable, nonsticky and nonplastic; slightly acid; abrupt smooth boundary.
- B21—8 to 17 inches; dark reddish brown (5YR 3/4) heavy silt loam; weak coarse subangular blocky structure; friable, slightly sticky and plastic; thin silt films lining pores; slightly acid; abrupt wavy boundary.
- B22—17 to 25 inches; reddish brown (5YR 4/3) heavy silt loam; common fine faint reddish gray (5YR 5/2), dark reddish gray (5YR 4/2), and brown (7.5YR 5/4) mottles; weak coarse subangular blocky structure; friable, slightly sticky and slightly plastic; thin silt films lining pores; medium acid; clear wavy boundary.
- B23—25 to 37 inches; reddish brown (5YR 4/4) sandy clay loam; common fine faint pinkish gray (5YR 6/2) and weak red (2.5YR 5/2) mottles; dark red (2.5YR 3/6) sand lenses; weak coarse subangular blocky structure; friable, slightly sticky and plastic; thin silt and clay films lining pores; medium acid; clear wavy boundary.

C1—37 to 52 inches; reddish gray (5YR 5/2) sandy loam; common coarse distinct strong brown (7.5YR 5/8), weak red (2.5YR 5/2), and prominent gray (N 6/ ) mottles; massive; friable, slightly sticky and plastic; few thin silt and clay films lining pores; 10 percent gravel; medium acid; clear wavy boundary.  
 IIC—52 to 62 inches; stratified sand and gravel.

The solum thickness ranges from 24 to 40 inches. Depth to stratified sand and gravel is more than 40 inches. Content of coarse fragments ranges from 0 to 10 percent in the solum, 0 to 25 percent in the C horizon and 30 to 85 percent in the IIC horizon. Reaction in unlimed areas ranges from very strongly acid to medium acid throughout.

The Ap horizon ranges from dark brown (7.5YR 3/2), reddish brown (5YR 5/4), and dark reddish brown (2.5YR 2/4) through reddish brown (2.5YR 4/4).

The B horizon ranges from dark reddish gray (5YR 4/2) and dark reddish brown (5YR 2/2 and 2.5YR 3/4) to reddish brown (5YR 4/3 and 2.5YR 5/4). Texture ranges from silt loam to sandy clay loam in the fine earth fraction.

The C horizon above stratified sand and gravel has hues similar to those in the B horizon. Texture ranges from sandy loam or sandy clay loam to silt loam or light silty clay loam in the fine earth fraction.

The IIC horizon is stratified sand gravel but includes lenses of silt or clay.

### Thorndale series

The Thorndale series consists of fine-silty, mixed, mesic Typic Fragiaqualfs. These deep, poorly drained soils are on flats and in drainageways on uplands. They have a dark brown silt loam Ap horizon and a mottled gray and light gray silty clay loam Bt horizon over a firm and brittle Bx horizon of mottled reddish brown and pale brown silty clay loam.

The principal associated soils are the well drained Hagerstown, Duffield, and Nolin soils on uplands; the moderately well drained Clarksburg soils on uplands; and the moderately well drained Lindsides soils and the poorly drained Melvin soils on flood plains.

Typical pedon of Thorndale silt loam, 0 to 3 percent slopes, in pasture, 6 miles southeast of Lebanon:

Ap—0 to 5 inches; dark brown (10YR 3/3) silt loam; weak thick platy structure parting to weak coarse granular friable, slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

B1—5 to 14 inches; grayish brown (10YR 5/2) silt loam; weak medium prismatic structure; friable, slightly sticky and slightly plastic; dark brown (7.5YR 4/4) coatings in worm holes and on ped faces; few soft black oxide concretions; slightly acid; clear smooth boundary.

B21tg—14 to 20 inches; gray (5Y 6/1) silty clay loam; many fine distinct brownish yellow (10YR 6/6) mottles in ped interiors; moderate medium prismatic structure; friable, slightly sticky and plastic; many thin clay films on ped faces; neutral; gradual wavy boundary.

B22tg—20 to 27 inches; gray (5Y 6/1) silty clay loam; many coarse distinct yellowish red (5YR 4/8) and light gray (5Y 7/1) mottles; moderate coarse prismatic structure; friable, sticky and plastic; many moderately thick clay films on ped faces; 5 percent coarse fragments; neutral; gradual wavy boundary.

B23tg—27 to 36 inches; light gray (5Y 7/1) silty clay loam; many coarse prominent yellowish red (5YR 5/6) mottles; strong coarse prismatic structure; friable, sticky and plastic; many moderately thick clay films on ped faces; few coarse black oxide coatings on peds; neutral; irregular and broken boundary.

Bx1g—36 to 51 inches; reddish brown (5YR 5/3) silty clay loam, light gray (5Y 7/1) ped faces; moderate very coarse prismatic structure; firm and brittle, sticky and plastic; common moderately thick clay films on ped faces; common coarse black oxide coatings on peds; strongly acid; diffuse wavy boundary.

Bx2g—51 to 60 inches; pale brown (10YR 6/3) silty clay loam, light gray (5Y 7/1) ped faces; common coarse distinct light gray (2.5Y N7/ ) and red (2.5YR 5/6) mottles; moderate very coarse prismatic structure; firm and brittle, slightly sticky and plastic; common moderately thick clay films on ped faces; few coarse black oxide coatings on peds; 4 percent coarse fragments; slightly acid; diffuse wavy boundary.

The solum thickness ranges from 40 to 60 inches. Depth to bedrock is more than 5 feet. The fragipan is at a depth of 20 to 36 inches. Content of coarse fragments ranges from 0 to 10 percent throughout the soil. Reaction in unlimed areas is strongly acid to neutral in the solum and medium acid to neutral in the C horizon.

The Ap horizon ranges from very dark gray (10YR 3/1) through olive (5Y 5/3) when moist. Dry colors range from dark grayish brown (10YR 4/1) to light gray (5Y 7/2).

The B2t horizon ranges from dark gray (5Y 4/1) to pink (5YR 7/3). High- and low- chroma mottles are throughout the Bt horizon. Texture is silty clay loam or silt loam in the fine earth fraction. Colors are similar in the Bx and B2t horizons. Texture ranges from silty clay loam to silt loam but is dominantly silty clay loam.

### Ungers series

The Ungers series consists of fine-loamy, mixed, mesic Typic Hapludults. These deep, well drained soils are on convex side slopes and tops of ridges on uplands. They have a dark brown loam A horizon; a reddish



brown loam, sandy clay loam, and gravelly sandy clay loam B horizon; and a weak red channery sandy loam C horizon.

The principal associated soils are the well drained Brecknock and Neshaminy soils; the moderately deep, well drained Penn soils; the deep, moderately well drained Readington soils; the deep, somewhat poorly drained Abbottstown soils; and the poorly drained and somewhat poorly drained Bowmansville soils. Ungers soils are redder than the Brecknock and Neshaminy soils.

Typical pedon of Ungers loam, in an area of Ungers extremely stony loam, 3 to 8 percent slopes, in woodland, one-quarter mile north of Mt. Gretna firehouse along Pennsylvania Route 117, then 200 feet south into woods:

- O1—3 to 2 inches; undecomposed leaf and twig litter.
- O2—2 inches to 0; very dark gray (10YR 3/1) organic mat.
- A1—0 to 3 inches; dark brown (7.5YR 4/4) loam; weak fine granular structure; friable, slightly sticky and nonplastic; 5 percent coarse fragments; very strongly acid; abrupt smooth boundary.
- B1—3 to 11 inches; reddish brown (5YR 4/4) loam; weak medium subangular blocky structure; friable, slightly sticky and nonplastic; few thin patchy clay films on ped faces; 5 percent coarse fragments; very strongly acid; clear wavy boundary.
- B21t—11 to 24 inches; reddish brown (2.5YR 4/4) sandy clay loam; strong coarse subangular blocky structure parting to medium subangular blocky; friable, slightly sticky and slightly plastic; common thin patchy clay films on pressure faces, bridging sand grains, and lining pores; 5 percent coarse fragments; very strongly acid; clear wavy boundary.
- B22t—24 to 40 inches; reddish brown (2.5YR 4/4) gravelly sandy clay loam; weak coarse subangular blocky structure parting to medium subangular blocky; firm, slightly sticky and nonplastic; common thin clay films bridging and coating sand grains, in pores, and on pressure faces; 25 percent coarse fragments; very strongly acid; gradual wavy boundary.
- C—40 to 60 inches; weak red (10R 4/4) channery sandy loam; massive; firm, slightly sticky and nonplastic; common thin patches of clay films on pressure faces, lining pores, and bridging and coating sand grains; 50 percent coarse fragments; very strongly acid.

The solum thickness ranges from 30 to 55 inches. Depth to bedrock ranges from 3-1/2 to 7 feet or more. Content of coarse fragments ranges from 5 to 15 percent in the A horizon, from 5 to 60 percent in the B horizon, and from 40 to 90 percent in the C horizon. In

unlimed areas the soil is extremely acid or very strongly acid throughout.

The Ap horizon ranges from brown (10YR 5/3) to dark reddish brown (5YR 3/2 and 2/5YR 3/4).

The B horizon ranges from reddish brown (5YR 5/4) to dusky red (10R 3/4). Texture ranges from loam to sandy clay loam in the fine earth fraction.

The color of the C horizon is similar to that of the B horizon. Texture is loam or sandy loam in the fine earth fraction.

## Watchung series

The Watchung series consists of fine, mixed, mesic Typic Ochraqualfs. These deep, poorly drained soils are in depressions and on flats and foot slopes on uplands. They have a dark gray silt loam A horizon, a mottled gray silty clay and clay Bt horizon, and a yellowish brown silty clay and strong brown silt loam C horizon.

The principal associated soils are Bowmansville, Mount Lucas, and Neshaminy soils. Bowmansville soils are on flood plains. Mount Lucas soils are moderately well drained and somewhat poorly drained. Neshaminy soils are well drained.

Typical pedon of Watchung silt loam, in an area of Watchung extremely stony silt loam, 0 to 8 percent slopes, in wooded area, one-eighth mile east of Colebrook on Pennsylvania Route 117:

- O1—2 inches to 1 inch; undecomposed leaf and twig litter.
- O2—1 inch to 0; black organic mat of decomposed leaves and twigs.
- A1—0 to 6 inches; dark gray (10YR 4/1) silt loam; weak fine granular structure; friable, slightly sticky and slightly plastic; medium acid; abrupt smooth boundary.
- A2g—6 to 11 inches; dark gray (5Y 4/1) silt loam; many medium distinct dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/8) mottles; weak thin platy structure; friable, slightly sticky and slightly plastic; medium acid; abrupt wavy boundary.
- B21tg—11 to 23 inches; gray (N 5/ ) silty clay; many medium distinct reddish brown (5YR 5/4) and yellowish brown (10YR 5/8) mottles; strong medium prismatic and angular blocky structure; firm, sticky and plastic; thick continuous clay films in pores and on ped faces; medium acid; clear wavy boundary.
- B22tg—23 to 26 inches; gray (N 6/ ) clay; many coarse distinct yellowish brown (10YR 5/8) mottles; strong coarse prismatic structure parting to moderate thick platy; firm, sticky and plastic; thick continuous clay films in pores and on ped faces; medium acid; clear wavy boundary.
- B23tg—26 to 35 inches; gray (5Y 6/1) silty clay; common medium distinct yellowish brown (10YR 5/8) mottles; strong coarse prismatic structure part-

ing to moderate thin platy; firm, sticky and plastic; thick continuous clay films in pores and on ped faces; medium acid; clear wavy boundary.

C1—35 to 50 inches; yellowish brown (10YR 5/6) silty clay; massive; firm, sticky and plastic; few thin discontinuous clay films in pores; neutral; gradual wavy boundary.

C2—50 to 62 inches; strong brown (7.5YR 5/6) silt loam; few fine distinct pale brown (10YR 6/3) mottles; massive; firm, slightly sticky and slightly plastic; slightly acid.

The solum thickness ranges from 24 to 48 inches. The lower boundary of the argillic horizon is within 40 inches of the surface. Depth to bedrock is 5 to 10 feet. Content of coarse fragments ranges from 0 to 20 percent throughout. Reaction ranges from medium acid to neutral in the B and C horizons.

The A horizon ranges from very dark gray (10YR 3/1) to olive (5Y 5/4).

The B horizon ranges from dark grayish brown (2.5Y 4/2) through gray (5Y 6/1) and through hue of 5BG, or neutral. Texture ranges from clay to heavy silty clay loam.

The C horizon ranges from strong brown (7.5YR 5/6) through dark gray (N 4/ ). Texture ranges from silt loam to light silty clay loam in the fine earth fraction.

### Weikert series

The Weikert series consists of loamy-skeletal, mixed, mesic Lithic Dystrichrepts. These shallow, well drained soils are on convex tops and sides of dissected ridges and hills. They have a dark brown shaly silt loam Ap horizon, a dark yellowish brown very shaly silt loam B horizon, and a yellowish brown very shaly silt loam C horizon over gray, fractured shale bedrock.

The principal associated soils are the shallow, well drained Klinesville soils; the moderately deep, well drained Berks soils; the deep, well drained Bedington soils; and the deep, moderately well drained and somewhat poorly drained Comly soils. Weikert soils are yellower than the Klinesville soils.

Typical pedon of Weikert shaly silt loam, 3 to 8 percent slopes, in hayfield 2 miles west on U.S. Highway from Lickdale:

Ap—0 to 9 inches; dark brown (10YR 4/3) shaly silt loam; moderate very coarse granular structure parting to coarse granular; friable, slightly sticky and slightly plastic; many small grass roots; 20 percent shale fragments; neutral; abrupt smooth boundary.

B2—9 to 14 inches; dark yellowish brown (10YR 4/4) very shaly silt loam; weak medium subangular blocky structure; friable, slightly sticky and slightly plastic; 50 percent shale fragments; strongly acid; clear wavy boundary.

C—14 to 17 inches; yellowish brown (10YR 5/6) very shaly silt loam; massive; friable, slightly sticky and slightly plastic; 65 percent shale fragments; very strongly acid; clear wavy boundary.

R—17 inches; fractured gray shale.

The solum ranges from 8 to 20 inches in thickness. Depth to bedrock ranges from 10 to 20 inches. Content of coarse fragments ranges from 20 to 50 percent in the A horizon, from 30 to 65 percent in the B horizon, and from 60 to 85 percent in the C horizon. Unless the soil is limed, reaction ranges from medium acid to very strongly acid throughout.

The Ap horizon ranges from very dark grayish brown (10YR 3/2) to brown (7.5YR 5/4).

The B horizon ranges from dark brown (10YR 4/3) to reddish yellow (7.5YR 6/6). Texture ranges from silt loam to loam in the fine earth fraction.

The C horizon has color and texture similar to the B horizon.

### References

- (1) American Association of State Highway (and Transportation) Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.
- (2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.
- (3) Hall, George M. 1967. Groundwater in Southeastern Pennsylvania. Pa. Geol. Surv., Ser. 4, Bull.-M50.
- (4) Meisler, Harold. 1963. Hydrology of the Carbonate of the Lebanon Valley, Pennsylvania. Pa. Geol. Surv., Ser. 4, Bull.-W18.
- (5) O'Neill, Bernard J. Jr. 1964. Atlas of Pennsylvania Mineral Resources: Part 1, Limestones and Dolomites of Pennsylvania. Pa. Geol. Surv., Ser. 4, Bull.-M50.
- (6) Pennsylvania Department of Internal Affairs. 1944. Pennsylvania's Mineral Heritage. Bur. Stat. Topogr. Geol. Surv.
- (7) Society of American Foresters. 1954. Forest cover types of North America. Rep. Comm. Forest Types, 67 pp.
- (8) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. (Supplements replacing pp. 173-188 issued May 1962)
- (9) United States Department of Agriculture. 1968. The timber resources of Pennsylvania. Forest Serv. Resour. Bull. E-8.
- (10) United States Department of Agriculture. 1975. Soil taxonomy: a basic system for making and inter-

preting soil surveys. U.S. Dep. Agric. Handb. 436, 754 pp., illus.

## Glossary

**Aeration, soil.** The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

**Aggregate, soil.** Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

**Alluvium.** Material, such as sand, silt, or clay, deposited on land by streams.

**Area reclaim.** An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

**Association, soil.** A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

**Available water capacity (available moisture capacity).** The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 40-inch profile or to a limiting layer is expressed as—

	<i>Inches</i>
Very low.....	less than 2.4
Low.....	2.4 to 3.2
Moderate.....	3.2 to 5.2
High.....	More than 5.2

**Base saturation.** The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

**Bedrock.** The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

**Calcareous soil.** A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

**Cation.** An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

**Channery soil.** A soil, that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

**Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

**Clay film.** A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

**Coarse fragments.** Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

**Colluvium.** Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

**Complex, soil.** A map unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

**Compressible.** Excessive decrease in volume of soft soil under load.

**Concretions.** Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

**Consistence, soil.** The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

*Loose.*—Noncoherent when dry or moist; does not hold together in a mass.

*Friable.*—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

*Firm.*—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

*Plastic.*—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

*Sticky.*—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

*Hard.*—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

*Soft.*—When dry, breaks into powder or individual grains under very slight pressure.

*Cemented.*—Hard; little affected by moistening.

**Contour stripcropping (or contour farming).** Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

**Control section.** The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

**Corrosive.** High risk of corrosion to uncoated steel or deterioration of concrete.

**Cover crop.** A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

**Cutbanks cave.** Unstable walls of cuts made by earth-moving equipment. The soil sloughs easily.

**Deferred grazing.** A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

**Depth to rock.** Bedrock at a depth that adversely affects the specified use.

**Diversion (or diversion terrace).** A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

**Drainage class (natural).** Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

*Excessively drained.*—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

*Somewhat excessively drained.*—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

*Well drained.*—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

*Moderately well drained.*—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

*Somewhat poorly drained.*—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained

soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

*Poorly drained.*—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

*Very poorly drained.*—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

**Drainage, surface.** Runoff, or surface flow of water, from an area.

**Eluviation.** The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

**Erosion.** The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

*Erosion (geologic).* Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

*Erosion (accelerated).* Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

**Excess fines.** Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

**Fast Intake.** The rapid movement of water into the soil.

**Favorable.** Favorable soil features for the specified use.

**Fertility, soil.** The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

**Field moisture capacity.** The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has drained

away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity*, *normal moisture capacity*, or *capillary capacity*.

**Flooding.** The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

**Flood plain.** A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

**Foot slope.** The inclined surface at the base of a hill.

**Forb.** Any herbaceous plant not a grass or a sedge.

**Fragipan.** A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

**Frost action.** Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

**Gleyed soil.** A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

**Grassed waterway.** A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

**Gravelly soil material.** Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

**Ground water** (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

**Habitat.** The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

**Horizon, soil.** A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

*O horizon.*—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

*A horizon.*—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

*A2 horizon.*—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

*B horizon.*—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

*C horizon.*—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

*R layer.*—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

**Humus.** The well decomposed, more or less stable part of the organic matter in mineral soils.

**Hydrologic soil groups.** Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

**Infiltration.** The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

**Large stones.** Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

**Leaching.** The removal of soluble material from soil or other material by percolating water.

**Liquid limit.** The moisture content at which the soil passes from a plastic to a liquid state.

**Loam.** Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

**Low strength.** Inadequate strength for supporting loads.

**Mineral soil.** Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

**Minimum tillage.** Only the tillage essential to crop production and prevention of soil damage.

**Morphology, soil.** The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

**Mottling, soil.** Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

**Munsell notation.** A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

**Neutral soil.** A soil having a pH value between 6.6 and 7.3.

**Parent material.** The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

**Ped.** An individual natural soil aggregate, such as a granule, a prism, or a block.

**Pedon.** The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

**Percolation.** The downward movement of water through the soil.

**Percs slowly.** The slow movement of water through the soil adversely affecting the specified use.

**Permeability.** The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

**Phase, soil.** A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

**pH value.** (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

**Piping.** Moving water of subsurface tunnels or pipelike cavities in the soil.

**Pitting.** Formation of pits as a result of the melting of ground ice after the removal of plant cover.

**Plasticity Index.** The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

**Plastic limit.** The moisture content at which a soil changes from a semisolid to a plastic state.

**Poorly graded.** Refers to soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

**Poor outlets.** Surface or subsurface drainage outlets difficult or expensive to install.

**Productivity (soil).** The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

**Profile, soil.** A vertical section of the soil extending through all its horizons and into the parent material.

**Reaction, soil.** The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid.....	Below 4.5
Very strongly acid.....	4.5 to 5.0
Strongly acid.....	5.1 to 5.5
Medium acid.....	5.6 to 6.0
Slightly acid.....	6.1 to 6.5
Neutral.....	6.6 to 7.3
Mildly alkaline.....	7.4 to 7.8
Moderately alkaline.....	7.9 to 8.4
Strongly alkaline.....	8.5 to 9.0
Very strongly alkaline.....	9.1 and higher



- Relief.** The elevations or inequalities of a land surface, considered collectively.
- Residuum (residual soil material).** Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.
- Rock fragments.** Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.
- Rooting depth.** Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.
- Root zone.** The part of the soil that can be penetrated by plant roots.
- Runoff.** The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.
- Sand.** As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.
- Sandstone.** Sedimentary rock containing dominantly sand-size particles.
- Saprolite** (geology). Soft, earthy, clay-rich, thoroughly decomposed rock formed in place by chemical weathering of igneous and metamorphic rock. In soil survey, the term saprolite is applied to any unconsolidated residual material underlying the soil and grading to hard bedrock below.
- Seasonal high water table.** A saturated zone in the soil that is within 6 to 36 inches of the surface during at least part of the year. It is generally associated with a perched water table and somewhat poorly drained and moderately well drained soils. It is indicated by mottling 6 to 36 inches from the surface.
- Seepage.** The rapid movement of water through the soil. Seepage adversely affects the specified use.
- Series, soil.** A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.
- Shale.** Sedimentary rock formed by the hardening of a clay deposit.
- Shrink-swell.** The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.
- Silt.** As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.
- Siltstone.** Sedimentary rock made up of dominantly silt-sized particles.
- Sinkhole.** A depression in a landscape where limestone has been locally dissolved.
- Site index.** A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.
- Slope.** The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.
- Slow intake.** The slow movement of water into the soil.
- Slow refill.** The slow filling of ponds, resulting from restricted permeability in the soil.
- Small stones.** Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.
- Soil.** A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.
- Solum.** The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.
- Stones.** Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.
- Stony.** Refers to a soil containing stones in numbers that interfere with or prevent tillage.
- Stratified.** Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.
- Stripcropping.** Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.
- Structure, soil.** The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself,

as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

**Subsoil.** Technically, the B horizon; roughly, the part of the solum below plow depth.

**Substratum.** The part of the soil below the solum.

**Subsurface layer.** Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

**Surface soil.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

**Terminal moraine.** A belt of thick glacial drift that generally marks the termination of important glacial advances.

**Terrace** (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

**Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt*, *silt loam*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

**Thin layer.** Otherwise suitable soil material too thin for the specified use.

**Till plain.** An extensive flat to undulating area underlain by glacial till.

**Tilth, soil.** The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil

in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

**Toe slope.** The outermost inclined surface at the base of a hill; part of a foot slope.

**Topsoil** (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

**Upland** (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

**Water table.** The upper limit of the soil or underlying rock material that is wholly saturated with water.

*Water table, apparent.* A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

*Water table, artesian.* A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

*Water table, perched.* A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

**Weathering.** All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

**Well graded.** Refers to a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.



## **TABLES**

TABLE 1.--TEMPERATURE AND PRECIPITATION  
 [Data are from Lebanon 3 SW, Pennsylvania, 1941-70]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with--		Average monthly total	One year in 10 will have--		Days with snow cover	Average depth of snow on days with snow cover
			Maximum temperature equal to or higher than--	Minimum temperature equal to or lower than--		Less than--	More than--		
	<u>°F</u>	<u>°F</u>	<u>°F</u>	<u>°F</u>	<u>In</u>	<u>In</u>	<u>In</u>		<u>In</u>
January---	36.8	19.9	51	1	2.81	1.38	4.65	18	5
February--	38.7	20.9	53	5	2.47	1.37	3.98	15	5
March-----	48.7	28.8	68	16	3.45	2.14	5.20	6	3
April-----	61.7	39.4	80	27	3.49	1.59	5.54	<.5	1
May-----	72.3	49.0	87	36	4.42	1.74	7.95	0	0
June-----	81.5	58.5	93	48	3.75	2.13	6.02	0	0
July-----	86.1	63.0	95	53	4.32	1.30	8.18	0	0
August----	83.9	60.7	94	50	3.86	1.80	6.73	0	0
September-	76.9	53.3	91	39	3.64	1.58	6.38	0	0
October---	66.2	42.8	81	30	3.10	1.06	5.41	0	0
November--	52.6	33.3	67	22	3.68	1.91	5.44	1	2
December--	39.6	23.1	55	7	3.31	1.25	5.39	9	4
Year----	62.1	41.1	97	-2	42.30	33.65	51.48	49	5

TABLE 2.--PROBABILITIES OF LAST FREEZING TEMPERATURES IN SPRING AND FIRST IN FALL

[Data are from Lebanon 3 SW, Pennsylvania, 1941-70]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than--	Mar. 21	Apr. 2	Apr. 13	Apr. 20	May 8
2 years in 10 later than--	Mar. 14	Mar. 27	Apr. 5	Apr. 16	May 3
5 years in 10 later than--	Mar. 2	Mar. 16	Mar. 26	Apr. 4	Apr. 23
Fall:					
1 year in 10 earlier than--	Nov. 23	Nov. 13	Nov. 1	Oct. 12	Sep. 28
2 years in 10 earlier than--	Dec. 1	Nov. 18	Nov. 6	Oct. 17	Oct. 4
5 years in 10 earlier than--	Dec. 8	Nov. 27	Nov. 15	Oct. 29	Oct. 16



TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AbA	Abbottstown silt loam, 0 to 3 percent slopes-----	406	0.2
AbB	Abbottstown silt loam, 3 to 8 percent slopes-----	579	0.2
BeA	Bedington shaly silt loam, 0 to 3 percent slopes-----	1,975	0.9
BeB	Bedington shaly silt loam, 3 to 8 percent slopes-----	12,619	5.4
BeC	Bedington shaly silt loam, 8 to 15 percent slopes-----	1,726	0.7
BeD	Bedington shaly silt loam, 15 to 25 percent slopes-----	896	0.4
BkB	Berks shaly silt loam, 3 to 8 percent slopes-----	15,999	6.9
BkC	Berks shaly silt loam, 8 to 15 percent slopes-----	8,810	3.8
BkD	Berks shaly silt loam, 15 to 25 percent slopes-----	2,814	1.2
Bm	Bowmansville silt loam-----	1,951	0.8
BnB	Brecknock channery silt loam, 3 to 8 percent slopes-----	883	0.4
BnC	Brecknock channery silt loam, 8 to 15 percent slopes-----	473	0.2
BrA	Brinkerton silt loam, 0 to 3 percent slopes-----	1,795	0.8
BrB	Brinkerton silt loam, 3 to 8 percent slopes-----	2,207	0.9
BwB	Buchanan gravelly loam, 3 to 8 percent slopes-----	836	0.4
BxB	Buchanan extremely stony loam, 3 to 8 percent slopes-----	1,021	0.4
BxC	Buchanan extremely stony loam, 8 to 25 percent slopes-----	1,365	0.6
ByB	Bucks silt loam, 3 to 8 percent slopes-----	1,738	0.7
CeB	Chester channery loam, 3 to 8 percent slopes-----	644	0.3
CeC	Chester channery loam, 8 to 15 percent slopes-----	753	0.3
ChC	Chester extremely stony loam, 8 to 25 percent slopes-----	1,846	0.8
CkA	Clarksburg silt loam, 0 to 3 percent slopes-----	4,178	1.8
CkB	Clarksburg silt loam, 3 to 8 percent slopes-----	4,942	2.1
CmA	Comly silt loam, 0 to 3 percent slopes-----	1,223	0.5
CmB	Comly silt loam, 3 to 8 percent slopes-----	4,126	1.8
DfA	Duffield silt loam, 0 to 3 percent slopes-----	2,402	1.0
DfB	Duffield silt loam, 3 to 8 percent slopes-----	17,547	7.6
DfC	Duffield silt loam, 8 to 15 percent slopes-----	1,367	0.6
Dp	Dumps-----	126	0.1
HaA	Hagerstown silt loam, 0 to 3 percent slopes-----	1,894	0.8
HaB	Hagerstown silt loam, 3 to 8 percent slopes-----	17,084	7.4
HbC	Hagerstown silty clay loam, 8 to 15 percent slopes-----	1,982	0.9
HeB	Hagerstown-Rock outcrop complex, 3 to 8 percent slopes-----	1,198	0.5
HeC	Hagerstown-Rock outcrop complex, 8 to 25 percent slopes-----	3,613	1.6
HHB	Hazleton extremely stony sandy loam, gently sloping-----	1,562	0.7
HHE	Hazleton extremely stony sandy loam, steep-----	7,655	3.3
HLD	Hazleton-Laidig association, moderately steep-----	3,756	1.6
Ho	Holly silt loam-----	7,933	3.4
KnB	Klinesville shaly silt loam, 3 to 8 percent slopes-----	1,871	0.8
KnC	Klinesville shaly silt loam, 8 to 15 percent slopes-----	1,204	0.5
KnD	Klinesville shaly silt loam, 15 to 25 percent slopes-----	1,005	0.4
LaB	Laidig channery loam, 3 to 8 percent slopes-----	921	0.4
LaC	Laidig channery loam, 8 to 15 percent slopes-----	725	0.3
LdB	Laidig extremely stony loam, 3 to 8 percent slopes-----	701	0.3
LdC	Laidig extremely stony loam, 8 to 25 percent slopes-----	12,424	5.4
LeB	Leck Kill shaly silt loam, 3 to 8 percent slopes-----	828	0.4
LeC	Leck Kill shaly silt loam, 8 to 15 percent slopes-----	1,009	0.4
LfC	Leck Kill very stony silt loam, 8 to 25 percent slopes-----	2,368	1.0
LhB	Lehigh silt loam, 2 to 10 percent slopes-----	489	0.2
Ls	Lindside silt loam-----	791	0.3
MaA	Markes silt loam, 0 to 5 percent slopes-----	1,204	0.5
Me	Melvin Variant silt loam-----	1,979	0.9
MoB	Mount Lucas silt loam, 3 to 8 percent slopes-----	383	0.2
MsB	Mount Lucas extremely stony silt loam, 3 to 8 percent slopes-----	546	0.2
MuB	Murrill gravelly silt loam, 3 to 8 percent slopes-----	1,194	0.5
NeB	Neshaminy gravelly silt loam, 3 to 8 percent slopes-----	2,004	0.9
NeC	Neshaminy gravelly silt loam, 8 to 15 percent slopes-----	2,210	1.0
NhB	Neshaminy extremely stony silt loam, 3 to 8 percent slopes-----	1,186	0.5
NhC	Neshaminy extremely stony silt loam, 8 to 25 percent slopes-----	4,766	2.1
NHE	Neshaminy extremely stony silt loam, steep-----	959	0.4
No	Nolin Variant silt loam-----	1,386	0.6
PeB	Penn shaly silt loam, 3 to 8 percent slopes-----	515	0.2
PeC	Penn shaly silt loam, 8 to 15 percent slopes-----	564	0.2
Ph	Philo silt loam-----	1,457	0.6
Po	Pope loam-----	523	0.2
Qu	Quarries-----	2,706	1.1
ReB	Readington silt loam, 3 to 8 percent slopes-----	935	0.4
Ro	Rowland silt loam-----	366	0.2
Ru	Rubble land-----	2,387	1.0
ThA	Thorndale silt loam, 0 to 3 percent slopes-----	666	0.3
ThB	Thorndale silt loam, 3 to 8 percent slopes-----	229	0.1
UnB	Ungers loam, 3 to 8 percent slopes-----	2,477	1.1

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
UnC	Ungers loam, 8 to 15 percent slopes-----	2,717	1.2
UnD	Ungers loam, 15 to 25 percent slopes-----	1,153	0.5
UoB	Ungers extremely stony loam, 3 to 8 percent slopes-----	1,035	0.4
UoC	Ungers extremely stony loam, 8 to 25 percent slopes-----	6,785	2.9
UPE	Ungers and Calvin soils, steep-----	2,362	1.0
UR	Urban land-Berks complex-----	1,216	0.5
US	Urban land-Hagerstown complex-----	3,834	1.7
WaA	Watchung silt loam, 0 to 5 percent slopes-----	813	0.3
WbB	Watchung extremely stony silt loam, 0 to 8 percent slopes-----	1,001	0.4
WeB	Weikert shaly silt loam, 3 to 8 percent slopes-----	3,138	1.4
WeC	Weikert shaly silt loam, 8 to 15 percent slopes-----	2,220	1.0
WeD	Weikert shaly silt loam, 15 to 25 percent slopes-----	3,645	1.6
WeE	Weikert shaly silt loam, 25 to 50 percent slopes-----	2,708	1.2
	Water-----	791	0.3
	Total-----	232,320	100.0

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn	Corn silage	Oats	Wheat	Alfalfa hay	Grass- legume hay	Pasture
	Bu	Ton	Bu	Bu	Ton	Ton	AUM*
AbA----- Abbottstown	95	19	60	---	---	3.0	6.0
AbB----- Abbottstown	95	19	60	---	---	3.0	6.0
BeA----- Bedington	130	26	75	50	5.0	3.5	9.5
BeB----- Bedington	130	26	75	50	5.0	3.5	9.5
BeC----- Bedington	120	24	70	45	4.5	3.5	8.5
BeD----- Bedington	105	21	60	40	4.0	3.0	7.5
BkB----- Berks	80	16	60	35	3.5	3.0	6.5
BkC----- Berks	75	15	55	35	3.0	2.5	5.5
BkD----- Berks	70	14	50	30	3.0	2.0	5.5
Bm----- Bowmansville	115	23	---	---	---	3.5	6.5
BnB----- Brecknock	95	19	65	40	3.5	3.0	7.0
BnC----- Brecknock	90	18	60	35	3.0	2.5	6.0
BrA----- Brinkerton	90	18	60	---	---	2.5	5.0
BrB----- Brinkerton	90	18	60	---	---	2.5	5.0
BWB----- Buchanan	100	20	65	40	3.5	3.0	---
BxB----- Buchanan	---	---	---	---	---	---	---
BxC----- Buchanan	---	---	---	---	---	---	---
ByB----- Bucks	135	27	80	50	5.5	3.5	10.5
CeB----- Chester	135	27	80	50	5.5	3.5	10.5
CeC----- Chester	125	25	75	45	5.0	3.5	9.5
ChC----- Chester	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Oats	wheat	Alfalfa hay	Grass- legume hay	Pasture
	<u>Bu</u>	<u>Ton</u>	<u>Bu</u>	<u>Bu</u>	<u>Ton</u>	<u>Ton</u>	<u>ADM*</u>
CkA----- Clarksburg	100	20	70	40	3.5	3.0	6.5
CkB----- Clarksburg	100	20	70	40	3.5	3.0	6.5
CmA----- Comly	100	20	65	40	3.5	3.0	6.5
CmB----- Comly	100	20	65	40	3.5	3.0	6.5
DfA----- Duffield	130	26	80	50	5.0	3.5	9.5
DfB----- Duffield	130	26	80	50	5.0	3.5	9.5
DfC----- Duffield	125	25	75	45	4.5	3.0	8.5
Dp**. Dumps							
HaA----- Hagerstown	135	27	80	50	5.5	3.5	10.0
HaB----- Hagerstown	135	27	80	50	5.5	3.5	10.0
HbC----- Hagerstown	120	24	70	40	4.5	3.5	9.0
HeB----- Hagerstown Rock Outcrop	---	---	---	---	---	---	6.5
HeC----- Hagerstown Rock Outcrop	---	---	---	---	---	---	6.0
HbB----- Hazleton	---	---	---	---	---	---	---
HbE----- Hazleton	---	---	---	---	---	---	---
HLD**: Hazleton	---	---	---	---	---	---	---
Laidig-----	---	---	---	---	---	---	---
Ho----- Holly	100	20	70	---	---	3.5	6.5
KnB----- Klinesville	60	12	55	25	2.5	2.0	5.0
KnC----- Klinesville	---	---	50	---	2.5	2.0	5.0
KnD----- Klinesville	---	---	---	---	---	---	4.5
LaB----- Laidig	100	20	70	40	4.0	3.0	7.5
LaC----- Laidig	95	19	65	35	4.0	3.0	7.5

See footnote at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Oats	Wheat	Alfalfa hay	Grass- legume hay	Pasture
	<u>Bu</u>	<u>Ton</u>	<u>Bu</u>	<u>Bu</u>	<u>Ton</u>	<u>Ton</u>	<u>AUM*</u>
LdB, LdC----- Laidig	---	---	---	---	---	---	---
LeB----- Leck Kill	125	25	70	50	4.5	3.5	9.0
LeC----- Leck Kill	120	24	65	45	4.0	3.5	8.5
LfC----- Leck Kill	---	---	---	---	---	---	---
LhB----- Lehigh	95	19	60	---	---	3.0	5.5
Ls----- Lindside	125	25	80	45	4.0	3.5	8.5
MaA----- Markes	70	14	55	---	---	2.5	5
Me----- Melvin Variant	110	22	70	---	---	3.0	6.0
MoB----- Mount Lucas	105	21	70	45	4.0	3.0	7.5
MsB----- Mount Lucas	---	---	---	---	---	---	---
MuB----- Murrill	120	24	75	45	4.5	3.5	8.5
NeB----- Neshaminy	135	27	80	50	5.5	3.5	10.5
NeC----- Neshaminy	125	25	75	45	5.0	3.5	9.5
NhB, NhC----- Neshaminy	---	---	---	---	---	---	---
NHE----- Neshaminy	---	---	---	---	---	---	---
No----- Nolin variant	135	27	80	45	5.0	4.5	10.0
PeB----- Penn	95	19	65	40	3.5	3.0	6.5
PeC----- Penn	90	18	60	35	3.0	2.5	5.5
Ph----- Philo	130	26	80	45	4.5	3.5	8.5
Po----- Pope	130	26	80	50	5.0	3.5	8.5
Qu**. Quarries							
ReB----- Readington	105	21	70	45	3.5	3.0	6.5
Ro----- Rowland	130	26	80	45	4.5	3.5	8.5

See footnote at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Corn silage	Oats	Wheat	Alfalfa hay	Grass- legume hay	Pasture
	<u>Bu</u>	<u>Ton</u>	<u>Bu</u>	<u>Bu</u>	<u>Ton</u>	<u>Ton</u>	<u>AUM*</u>
Ru**, Rubble land							
ThA----- Thorndale	---	---	---	---	---	---	5.5
TnB----- Thorndale	---	---	---	---	---	---	5.5
UnB----- Ungers	120	24	75	45	4.5	3.5	8.5
UnC----- Ungers	110	22	70	40	4.0	3.0	8.0
UnD----- Ungers	95	19	65	35	4.0	3.0	8.0
UoB, UoC----- Ungers	---	---	---	---	---	---	---
UPE----- Ungers and Calvin	---	---	---	---	---	---	---
UR----- Urban land-Berks	---	---	---	---	---	---	---
US----- Urban land-Hagerstown	---	---	---	---	---	---	---
WaA----- Watchung	---	---	---	---	---	2.0	4.0
WbB----- Watchung	---	---	---	---	---	---	---
WeB----- Weikert	60	12	50	25	---	---	4.0
WeC----- Weikert	---	---	45	20	2.0	---	4.0
WeD----- Weikert	---	---	---	---	---	---	---
WeE----- Weikert	---	---	---	---	---	---	---

\* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for a period of 30 days.

\*\* See map unit description for the composition and behavior of the map unit.

TABLE 5.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas excluded. Absence of an entry means no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
I	8,180	---	---	---
II	94,600	86,585	8,015	---
III	41,891	28,556	13,335	---
IV	16,238	11,032	5,206	---
V	1,479	---	1,479	---
VI	24,373	4,650	229	19,494
VII	36,458	4,078	---	32,380
VIII	2,387	---	---	---



TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	
AbA, AbB----- Abbottstown	3w	Slight	Moderate	Moderate	Moderate	Northern red oak----- White ash----- Sugar maple----- Red maple----- Yellow-poplar-----	70 70 70 80 80	Yellow-poplar, European larch, eastern white pine, Norway spruce, white spruce.
BeA, BeB, BeC----- Bedington	2o	Slight	Slight	Slight	Slight	Northern red oak----- Yellow-poplar-----	75 85	Black walnut, yellow-poplar, eastern white pine, European larch, Norway spruce, Virginia pine.
BeD----- Bedington	2r	Moderate	Moderate	Slight	Slight	Northern red oak----- Yellow-poplar-----	75 85	Black walnut, yellow-poplar, eastern white pine, European larch, Norway spruce, Virginia pine.
BkB, BkC----- Berks	3f	Slight	Slight	Moderate	Slight	Northern red oak----- Black oak----- Virginia pine-----	70 70 70	Virginia pine, eastern white pine, Norway spruce, red pine.
BkD----- Berks	3f	Slight	Moderate	Moderate	Slight	Northern red oak----- Black oak----- Virginia pine-----	70 70 70	Virginia pine, eastern white pine, Norway spruce, red pine.
Bm----- Bowmansville	1w	Slight	Severe	Severe	Moderate	Pin oak-----	85	Eastern white pine, white spruce, loblolly pine.
BnB, BnC----- Brecknock	4o	Slight	Slight	Slight	Slight	Northern red oak----- Virginia pine----- Shortleaf pine-----	58 60 60	Eastern white pine, Virginia pine, loblolly pine.
BrA, BrB----- Brinkerton	2w	Slight	Severe	Severe	Moderate	Northern red oak-----	77	Eastern white pine, white spruce, red maple, yellow-poplar.
BwB----- Buchanan	3o	Slight	Slight	Slight	Slight	Northern red oak----- Yellow-poplar-----	66 91	Northern red oak, yellow-poplar, sugar maple, eastern white pine, European larch, Norway spruce.
BxB----- Buchanan	3x	Slight	Moderate	Slight	Slight	Northern red oak----- Yellow-poplar-----	66 91	Northern red oak, yellow-poplar, sugar maple, eastern white pine, European larch, Norway spruce.
BxC----- Buchanan	3r	Moderate	Moderate	Slight	Slight	Northern red oak----- Yellow-poplar-----	66 91	Northern red oak, yellow-poplar, sugar maple, eastern white pine, European larch, Norway spruce.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	
ByB----- Bucks	3o	Slight	Slight	Slight	Slight	Northern red oak----- Yellow-poplar----- Virginia pine----- Shortleaf pine-----	68 80 70 70	Eastern white pine, yellow-poplar, Norway spruce, European larch, Virginia pine, loblolly pine.
CeB, CeC----- Chester	2o	Slight	Slight	Slight	Slight	Chestnut oak----- Yellow-poplar----- Virginia pine----- Shortleaf pine-----	77 83 80 80	Black walnut, yellow-poplar, eastern white pine, loblolly pine, western larch.
ChC----- Chester	2x	Moderate	Severe	Slight	Slight	Black oak----- Yellow-poplar----- Virginia pine----- Shortleaf pine-----	77 83 80 80	Black walnut, yellow-poplar.
CkA, CkB----- Clarksburg	3w	Slight	Moderate	Moderate	Slight	Northern red oak----- Yellow-poplar-----	75 85	Eastern white pine, yellow-poplar, European larch, Norway spruce.
CmA, CmB----- Comly	3o	Slight	Slight	Slight	Slight	Northern red oak----- White ash----- Sugar maple----- Yellow-poplar-----	70 70 70 80	Yellow-poplar, European larch, Norway spruce, eastern white pine.
DfA, DfB, DfC----- Duffield	1o	Slight	Slight	Slight	Slight	Northern red oak----- Yellow-poplar-----	85 100	Yellow-poplar, black walnut, Norway spruce, European larch, eastern white pine.
HaA, HaB, HbC----- Hagerstown	1c	Slight	Moderate	Slight	Slight	Northern red oak----- Yellow-poplar-----	85 100	Black walnut, yellow-poplar, eastern white pine, Norway spruce.
HeB*: Hagerstown-----	1c	Slight	Moderate	Slight	Slight	Northern red oak----- Yellow-poplar-----	85 100	Black walnut, yellow-poplar, eastern white pine, Norway spruce.
Rock outcrop.								
HeC*: Hagerstown-----	1c	Moderate	Severe	Slight	Slight	Northern red oak----- Yellow-poplar-----	85 100	Black walnut, yellow-poplar, eastern white pine, Norway spruce.
Rock outcrop.								
HHB----- Hazleton	3x	Slight	Moderate	Slight	Slight	Northern red oak----- Yellow-poplar-----	70 80	European larch, eastern white pine, Norway spruce, Austrian pine, black cherry.
HHE----- Hazleton	3x	Slight	Severe	Slight	Slight	Northern red oak----- Yellow-poplar-----	70 80	European larch, eastern white pine, Norway spruce, Austrian pine, black cherry.

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	Trees to plant
HLD*: Hazleton-----	3x	Slight	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar-----	70 80	European larch, eastern white pine, Norway spruce, Austrian pine, black cherry.
Laidig-----	3x	Slight	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar----- Eastern white pine-- Virginia pine-----	69 75 80 70	Eastern white pine, yellow-poplar, black walnut, Virginia pine, European larch, Norway spruce, black locust.
Ho----- Holly	2w	Slight	Severe	Severe	Moderate	Pin oak----- Red maple----- White ash-----	90 55 55	Eastern white pine, white spruce.
KnB, KnC----- Klinesville	4d	Slight	Slight	Moderate	Slight	Northern red oak---- Virginia pine-----	60 60	Virginia pine, eastern white pine, red pine, pitch pine.
KnD----- Klinesville	4d	Slight	Moderate	Moderate	Slight	Northern red oak---- Virginia pine-----	60 60	Virginia pine, eastern white pine, red pine, pitch pine.
LaB, LaC----- Laidig	3o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar----- Eastern white pine-- Virginia pine-----	69 85 80 70	Eastern white pine, yellow-poplar, black walnut, Virginia pine, European larch, Norway spruce, black locust.
LdB----- Laidig	3x	Slight	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar----- Eastern white pine-- Virginia pine-----	69 75 80 70	Eastern white pine, yellow-poplar, black walnut, Virginia pine, European larch, Norway spruce, black locust.
LdC----- Laidig	3x	Slight	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar----- Eastern white pine-- Virginia pine-----	69 75 80 70	Eastern white pine, yellow-poplar, black walnut, Virginia pine, European larch, Norway spruce, black locust.
LeB, LeC----- Leck Kill	3o	Slight	Slight	Slight	Slight	Northern red oak----	63	Eastern white pine, Virginia pine.
LfC----- Leck Kill	3r	Slight	Moderate	Slight	Slight	Northern red oak----	63	Eastern white pine, Virginia pine.
LhB----- Lehigh	3w	Slight	Moderate	Moderate	Moderate	Northern red oak---- White ash----- Sugar maple----- Red maple----- Yellow-poplar-----	70 70 70 70 80	Yellow-poplar, European larch, Norway spruce, white spruce, eastern white pine.
Ls----- Lindside	1w	Slight	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar-----	85 95	Eastern white pine, yellow-poplar.

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	
MaA----- Markes	4w	Slight	Severe	Severe	Severe	Northern red oak---- Red maple-----	60 60	Eastern white pine, white spruce.
Me----- Melvin Variant	1w	Slight	Severe	Severe	Slight	Pin oak-----	100	Pin oak, American sycamore, sweetgum, loblolly pine.
MoB----- Mount Lucas	2w	Slight	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar----- Virginia pine-----	80 90 75	Eastern white pine, yellow-poplar, Virginia pine.
MsB----- Mount Lucas	2x	Slight	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar----- Virginia pine-----	80 90 75	Eastern white pine, yellow-poplar, Virginia pine.
MJB----- Murrill	3o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar-----	72 85	Eastern white pine, yellow-poplar, black walnut, Norway spruce, Virginia pine, European larch.
NeB, NeC----- Neshaminy	2o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar-----	80 90	Eastern white pine, yellow-poplar, black walnut, Virginia pine, Norway spruce, European larch.
NhB, NhC----- Neshaminy	2x	Slight	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar-----	80 90	Eastern white pine, yellow-poplar, black walnut, Virginia pine, Norway spruce, European larch.
NHE----- Neshaminy	2x	Moderate	Severe	Slight	Slight	Northern red oak---- Yellow-poplar-----	80 90	Eastern white pine, yellow-poplar, black walnut, Virginia pine, Norway spruce, European larch.
No----- Nolin Variant	1o	Slight	Slight	Slight	Slight	Sweetgum-----	85	Sweetgum, yellow-poplar, eastern white pine, eastern cottonwood, white ash, cherrybark oak.
PeB, PeC----- Penn	3o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar----- Virginia pine----- Shortleaf pine-----	67 75 69 70	Yellow-poplar, Virginia pine, Norway spruce, European larch, loblolly pine.
Ph----- Philo	1w	Slight	Moderate	Slight	Slight	Virginia pine----- Northern red oak---- Yellow-poplar----- Shortleaf pine----- Loblolly pine----- Sweetgum-----	74 79 102 80 85 90	Eastern white pine, yellow-poplar, loblolly pine.

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	
Po----- Pope	2o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar----- Eastern white pine-- Virginia pine-----	80 102 89 74	Eastern white pine, yellow-poplar, loblolly pine, black walnut, black cherry, Norway spruce, European larch.
ReB----- Readington	3o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar----- Virginia pine----- Shortleaf pine-----	74 80 75 75	Eastern white pine, European larch, yellow-poplar, Norway spruce.
Ro----- Rowland	2w	Slight	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar-----	80 95	Eastern white pine, yellow-poplar, loblolly pine, Norway spruce, European larch.
ThA, ThB----- Thorndale	4w	Slight	Severe	Severe	Severe	Northern red oak---- Red maple-----	60 60	Eastern white pine, white spruce.
UnB, JnC----- Ungers	4o	Slight	Slight	Slight	Slight	Northern red oak---- Virginia pine-----	62 60	Eastern white pine, Virginia pine, European larch, Norway spruce.
UnD----- Ungers	4r	Slight	Moderate	Slight	Slight	Northern red oak---- Virginia pine-----	62 60	Eastern white pine, Virginia pine, European larch, Norway spruce.
UoB, UoC----- Ungers	4x	Slight	Moderate	Slight	Slight	Northern red oak---- Virginia pine-----	62 60	Eastern white pine, European larch, Virginia pine, Norway spruce.
UPE*; Ungers-----	4r	Slight	Severe	Slight	Slight	Northern red oak---- Virginia pine-----	62 ---	Eastern white pine, Virginia pine, European larch, Norway spruce.
Calvin-----	2f	Moderate	Severe	Moderate	Slight	Yellow-poplar----- Northern red oak---- Northern red oak----	80 77 67	Eastern white pine, red pine, Virginia pine, eastern white pine, red pine, Virginia pine, Norway spruce, European larch.
Ur*; Urban land. Berks-----	3f	Slight	Moderate	Moderate	Slight	Northern red oak---- Black oak----- Virginia pine-----	70 70 70	Virginia pine, eastern white pine, Norway spruce, red pine.
US*; Urban land. Hagerstown-----	1x	Slight	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar-----	85 95	Black walnut, yellow-poplar, eastern white pine, Norway spruce.
WaA----- Watchung	1w	Slight	Severe	Severe	Slight	Black oak----- Pin oak-----	80 85	Eastern white pine, European larch, Norway spruce.

See footnote at end of table.

TABLE 6.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Wind-throw hazard	Common trees	Site index	
WbB----- Watchung	1x	Slight	Severe	Severe	Slight	Northern red oak---- Pin oak-----	80 85	Eastern white pine, European larch, Norway spruce.
WeB, WeC----- Weikert	4d	Slight	Slight	Severe	Moderate	Northern red oak---- Virginia pine-----	59 56	Virginia pine, shortleaf pine, red pine, eastern white pine.
WeD----- Weikert	4d	Slight	Moderate	Severe	Moderate	Northern red oak---- Virginia pine-----	64 60	Eastern white pine, shortleaf pine, Virginia pine.
WeE----- Weikert	4d	Moderate	Severe	Severe	Moderate	Northern red oak---- Virginia pine-----	64 60	Eastern white pine, shortleaf pine, Virginia pine.

\* See map unit description for the composition and behavior of the map unit.

TABLE 7.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AbA, AbB----- Abbottstown	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.	Severe: wetness, frost action.	Severe: frost action.	Moderate: wetness.
BeA----- Bedington	Slight-----	Moderate: frost action.	Slight-----	Moderate: frost action.	Moderate: frost action.	Moderate: small stones.
BeB----- Bedington	Moderate: slope.	Moderate: frost action, slope.	Moderate: slope.	Moderate: slope.	Moderate: frost action.	Moderate: small stones.
BeC----- Bedington	Moderate: slope.	Moderate: slope, frost action.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, small stones.
BeD----- Bedington	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
BkB----- Berks	Moderate: depth to rock.	Moderate: frost action.	Moderate: depth to rock.	Moderate: slope, frost action.	Moderate: frost action.	Moderate: depth to rock, small stones.
BkC----- Berks	Moderate: slope, depth to rock.	Moderate: slope, frost action.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, depth to rock, small stones.
BkD----- Berks	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bm----- Bowmansville	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods.
BnB----- Brecknock	Moderate: depth to rock.	Moderate: frost action.	Moderate: depth to rock.	Moderate: frost action.	Moderate: frost action.	Moderate: small stones.
BnC----- Brecknock	Moderate: depth to rock, slope.	Moderate: frost action, slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: frost action, slope.	Moderate: small stones.
BrA, BrB----- Brinkerton	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness, frost action.	Severe: wetness.
BwB----- Buchanan	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.	Severe: wetness, frost action.	Severe: frost action.	Moderate: small stones, wetness.
BxB----- Buchanan	Severe: wetness, large stones.	Severe: wetness, large stones, frost action.	Severe: wetness, large stones.	Severe: wetness, large stones, frost action.	Severe: frost action, large stones.	Severe: large stones.
BxC----- Buchanan	Severe: slope, wetness, large stones.	Severe: slope, wetness, large stones.	Severe: slope, wetness, large stones.	Severe: slope, wetness, large stones.	Severe: slope, large stones, frost action.	Severe: slope, large stones.
ByB----- Bucks	Slight-----	Moderate: frost action.	Slight-----	Moderate: slope, frost action.	Moderate: frost action.	Slight.



TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
CeB----- Chester	Slight-----	Moderate: frost action.	Slight-----	Moderate: slope, frost action.	Moderate: low strength, frost action.	Moderate: small stones.
CeC----- Chester	Moderate: slope.	Moderate: slope, frost action.	Moderate: slope.	Severe: slope.	Moderate: slope, low strength, frost action.	Moderate: small stones, slope.
ChC----- Chester	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
CkA, CkB----- Clarksburg	Moderate: wetness.	Moderate: wetness, frost action, shrink-swell.	Severe: wetness.	Moderate: wetness, frost action.	Moderate: frost action, snrink-swell.	Slight.
CmA----- Comly	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action, low strength.	Moderate: wetness.
CmB----- Comly	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness, frost action, low strength.	Moderate: wetness.
DfA, DfB----- Duffield	Slight-----	Moderate: shrink-swell, frost action.	Moderate: shrink-swell.	Moderate: shrink-swell, frost action.	Moderate: shrink-swell, frost action.	Slight.
DfC----- Duffield	Moderate: slope.	Moderate: slope, shrink-swell, frost action.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, frost action, slope.	Moderate: slope.
Dp*. Dumps						
HaA----- Hagerstown	Moderate: depth to rock, too clayey.	Moderate: low strength, frost action, shrink-swell.	Moderate: depth to rock, low strength, shrink-swell.	Moderate: low strength, frost action, shrink-swell.	Severe: low strength.	Slight.
HaB----- Hagerstown	Moderate: depth to rock, too clayey.	Moderate: low strength, frost action, shrink-swell.	Moderate: depth to rock, low strength, shrink-swell.	Moderate: slope, low strength, frost action.	Severe: low strength.	Slight.
HbC----- Hagerstown	Moderate: slope, depth to rock, too clayey.	Moderate: slope, low strength, frost action.	Moderate: slope, depth to rock, low strength.	Severe: slope.	Severe: low strength.	Moderate: slope.
HeB*: Hagerstown-----	Moderate: depth to rock, too clayey.	Moderate: low strength, frost action, shrink-swell.	Moderate: depth to rock, low strength, shrink-swell.	Moderate: slope, low strength, frost action.	Severe: low strength.	Slight.
Rock outcrop.						
HeC*: Hagerstown-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
Rock outcrop.						

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
HBB----- Hazleton	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Moderate: frost action, large stones.	Severe: large stones.
HBE----- Hazleton	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.
HLD*----- Hazleton	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.
Laidig-----	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.
Ho----- Holly	Severe: floods, wetness.	Severe: floods, wetness, frost action.	Severe: floods, wetness.	Severe: floods, wetness, frost action.	Severe: floods, wetness, frost action.	Severe: wetness, floods.
KnB----- Klinesville	Moderate: depth to rock.	Moderate: depth to rock, frost action.	Moderate: depth to rock.	Moderate: slope, depth to rock, frost action.	Moderate: depth to rock, frost action.	Moderate: small stones, depth to rock.
KnC----- Klinesville	Moderate: slope, depth to rock.	Moderate: slope, depth to rock, frost action.	Moderate: slope.	Severe: slope.	Moderate: slope, depth to rock, frost action.	Moderate: slope, small stones, frost action.
KnD----- Klinesville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
LaB----- Laidig	Moderate: wetness, small stones.	Moderate: frost action.	Moderate: wetness.	Moderate: slope, frost action.	Moderate: frost action.	Moderate: small stones.
LaC----- Laidig	Moderate: small stones, wetness, slope.	Moderate: slope, frost action.	Moderate: slope, wetness.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, small stones.
LdB----- Laidig	Severe: wetness.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Moderate: large stones, frost action.	Severe: large stones.
LdC----- Laidig	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.
LeB----- Leck Kill	Slight-----	Moderate: frost action.	Slight-----	Moderate: slope, frost action.	Moderate: frost action.	Moderate: small stones.
LeC----- Leck Kill	Moderate: slope.	Moderate: slope, frost action.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, small stones.
LfC----- Leck Kill	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
LhB----- Lehigh	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.	Severe: wetness, frost action.	Severe: frost action.	Moderate: wetness.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
La----- Lindside	Severe: floods, wetness.	Severe: floods, frost action.	Severe: floods, wetness.	Severe: floods, frost action.	Severe: floods, frost action.	Moderate: floods.
MaA----- Markes	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness, frost action.	Severe: wetness.
Me----- Melvin Variant	Severe: floods, wetness, frost action.	Severe: floods, wetness.	Severe: floods, wetness, frost action.	Severe: floods, wetness.	Severe: floods, wetness, frost action.	Severe: floods, wetness.
MoB----- Mount Lucas	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.	Severe: wetness, frost action.	Severe: frost action.	Moderate: wetness.
MsB----- Mount Lucas	Severe: wetness, large stones.	Severe: wetness, large stones, frost action.	Severe: wetness, large stones.	Severe: wetness, large stones, frost action.	Severe: frost action.	Severe: large stones.
MuB----- Murrill	Moderate: small stones.	Moderate: frost action.	Slight-----	Moderate: frost action, slope.	Moderate: frost action.	Moderate: small stones.
NeB----- Neshaminy	Moderate: depth to rock.	Moderate: frost action.	Moderate: depth to rock.	Moderate: frost action, slope.	Moderate: frost action.	Moderate: small stones.
NeC----- Neshaminy	Moderate: depth to rock.	Moderate: frost action.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: frost action, slope.	Moderate: small stones, slope.
NhB----- Neshaminy	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Moderate: frost action.	Severe: large stones.
NhC, NHE----- Neshaminy	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.
No----- Nolin Variant	Severe: floods.	Severe: floods, frost action.	Severe: floods.	Severe: floods, frost action.	Severe: floods, frost action.	Moderate: floods.
PeB----- Penn	Moderate: depth to rock.	Moderate: frost action.	Moderate: depth to rock.	Moderate: slope, frost action.	Moderate: frost action.	Moderate: depth to rock, small stones.
PeC----- Penn	Moderate: depth to rock, slope.	Moderate: slope, frost action.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, frost action.	Moderate: depth to rock, small stones.
Ph----- Philo	Severe: floods, wetness.	Severe: floods, wetness, frost action.	Severe: floods, wetness.	Severe: floods, wetness, frost action.	Severe: floods, frost action.	Moderate: floods.
Po----- Pope	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
Qu*, Quarries						
ReB----- Readington	Severe: wetness.	Moderate: wetness, frost action.	Severe: wetness.	Moderate: slope, wetness, frost action.	Moderate: frost action, low strength.	Slight.
Ro----- Rowland	Severe: floods, wetness.	Severe: wetness, floods, frost action.	Severe: wetness, floods.	Severe: wetness, floods, frost action.	Severe: floods, wetness, frost action.	Moderate: floods, wetness.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ru*. Rubble land						
ThA, ThB----- Thorndale	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness, frost action.	Severe: wetness.
UnB----- Ungers	Slight-----	Moderate: frost action.	Slight-----	Moderate: slope, frost action.	Moderate: frost action.	Slight.
UnC----- Ungers	Moderate: slope.	Moderate: slope, frost action.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
UnD----- Ungers	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
UoB----- Ungers	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Moderate: frost action, large stones.	Severe: large stones.
UoC----- Ungers	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.
UPE*: Ungers-----	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.
Calvin-----	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.
UR*: Urban land.						
Berks-----	Moderate: slope, depth to rock.	Moderate: slope, frost action.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, depth to rock, small stones.
US*: Urban land.						
Hagerstown-----	Moderate: slope, depth to rock, too clayey.	Moderate: slope, low strength, frost action.	Moderate: slope, depth to rock, low strength.	Severe: slope.	Severe: low strength.	Moderate: slope.
WaA----- Watchung	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness, frost action.	Severe: wetness.
WbB----- Watchung	Severe: wetness, large stones.	Severe: wetness, frost action, large stones.	Severe: wetness, large stones.	Severe: wetness, large stones.	Severe: wetness, frost action.	Severe: wetness, large stones.
WeB----- Weikert	Moderate: depth to rock.	Moderate: depth to rock, frost action.	Moderate: depth to rock.	Moderate: slope, depth to rock, frost action.	Moderate: depth to rock, frost action.	Moderate: small stones.
WeC----- Weikert	Moderate: depth to rock, slope.	Moderate: slope, depth to rock, frost action.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope, depth to rock, frost action.	Moderate: slope, small stones.
WeD, WeE----- Weikert	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

\* See map unit description for the composition and behavior of the map unit.

TABLE 8.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," and "fair." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AbA----- Abbottstown	Severe: percs slowly, wetness.	Moderate: depth to rock.	Severe: wetness, depth to rock.	Severe: wetness.	Fair: small stones, too clayey.
AbB----- Abbottstown	Severe: percs slowly, wetness.	Moderate: depth to rock, slope.	Severe: wetness, depth to rock.	Severe: wetness.	Fair: small stones, too clayey.
BeA, BeB----- Bedington	Moderate: depth to rock.	Moderate: seepage.	Severe: depth to rock.	Slight-----	Fair: thin layer, small stones.
BeC----- Bedington	Moderate: slope, depth to rock.	Severe: slope.	Severe: depth to rock.	Moderate: slope.	Fair: slope, thin layer, small stones.
BeD----- Bedington	Severe: slope.	Severe: slope.	Severe: depth to rock.	Severe: slope.	Poor: slope.
BkB----- Berks	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: small stones.
BkC----- Berks	Severe: depth to rock.	Severe: slope, seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: small stones.
BkD----- Berks	Severe: depth to rock, slope.	Severe: slope, seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: seepage, slope.	Poor: small stones, slope.
Bm----- Bowmansville	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness, seepage.	Severe: floods, wetness.	Poor: wetness.
BnB----- Brecknock	Moderate: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Slight-----	Fair: small stones.
BnC----- Brecknock	Moderate: slope, depth to rock.	Severe: slope.	Severe: depth to rock.	Moderate: slope.	Fair: slope, small stones.
BrA----- Brinkerton	Severe: wetness, percs slowly.	Slight-----	Severe: wetness.	Severe: wetness.	Poor: wetness.
BrB----- Brinkerton	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
BwB----- Buchanan	Severe: wetness, percs slowly.	Moderate: slope, small stones.	Severe: wetness.	Severe: wetness.	Fair: small stones, thin layer.
BxB----- Buchanan	Severe: wetness, large stones.	Severe: large stones.	Severe: wetness, large stones.	Severe: wetness.	Poor: large stones.
BxC----- Buchanan	Severe: slope, wetness, large stones.	Severe: slope, large stones.	Severe: wetness, large stones.	Severe: slope, wetness.	Poor: slope, large stones.

TABLE 8.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
ByB----- Bucks	Moderate: depth to rock.	Moderate: seepage, depth to rock.	Severe: depth to rock.	Slight-----	Fair: thin layer.
CeB----- Chester	Slight-----	Moderate: slope, seepage.	Slight-----	Slight-----	Fair: small stones.
CeC----- Chester	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.	Fair: small stones.
ChC----- Chester	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones.	Severe: slope.	Poor: slope, large stones.
CkA----- Clarksburg	Severe: wetness, percs slowly.	Slight**-----	Severe: wetness.	Severe: wetness.	Fair**: thin layer.
CkB----- Clarksburg	Severe: wetness, percs slowly.	Moderate**: slope.	Severe: wetness.	Severe: wetness.	Fair**: thin layer.
CmA----- Comly	Severe: percs slowly, wetness.	Moderate: seepage.	Severe: wetness, depth to rock.	Severe: wetness.	Fair: thin layer.
CmB----- Comly	Severe: percs slowly, wetness.	Moderate: slope, seepage.	Severe: wetness, depth to rock.	Severe: wetness.	Fair: thin layer.
DfA, DfB----- Duffield	Moderate**: depth to rock.	Moderate**: depth to rock.	Severe: depth to rock.	Slight***-----	Fair**: too clayey.
DfC----- Duffield	Moderate**: depth to rock.	Severe: slope.	Severe: depth to rock.	Moderate**: slope.	Fair**: too clayey.
Dp*, Dumps					
HaA----- Hagerstown	Moderate**: depth to rock.	Moderate**: seepage, depth to rock.	Severe: depth to rock, too clayey.	Slight**-----	Poor: too clayey.
HaB----- Hagerstown	Moderate**: depth to rock.	Moderate**: slope, seepage, depth to rock.	Severe: depth to rock, too clayey.	Slight**-----	Poor: too clayey.
HbC----- Hagerstown	Moderate**: slope, depth to rock.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate**: slope.	Poor: too clayey.
HeB*: Hagerstown-----	Moderate**: depth to rock.	Moderate**: slope, seepage, depth to rock.	Severe: depth to rock, too clayey.	Slight**-----	Poor: too clayey.
Rock outcrop.					
HeC*: Hagerstown-----	Severe: slope.	Severe: slope.	Severe: depth to rock, too clayey.	Severe: slope.	Poor: slope, too clayey.
Rock outcrop.					
HHB----- Hazleton	Severe: large stones.	Severe: seepage, large stones.	Severe: seepage, large stones, depth to rock.	Severe: seepage.	Poor: small stones, large stones.

See footnotes at end of table.

TABLE 8.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
HHE----- Hazleton	Severe: slope, large stones.	Severe: slope, seepage, large stones.	Severe: slope, seepage, large stones.	Severe: slope, seepage.	Poor: slope, small stones, large stones.
HLD*: Hazleton-----	Severe: slope.	Severe: slope, seepage.	Severe: seepage, large stones, depth to rock.	Severe: slope, seepage.	Poor: slope, small stones, large stones.
Laidig-----	Severe: slope, percs slowly, wetness.	Severe: slope, large stones.	Severe: wetness, large stones.	Severe: slope.	Poor: slope, large stones.
Ho----- Holly	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness, seepage.	Severe: floods, wetness.	Poor: wetness.
KnB----- Klinesville	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: thin layer.
KnC----- Klinesville	Severe: depth to rock.	Severe: slope, depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: thin layer.
KnD----- Klinesville	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: slope, seepage.	Poor: slope, thin layer.
LaB----- Laidig	Severe: percs slowly, wetness.	Moderate: slope, small stones.	Severe: wetness.	Moderate: wetness.	Fair: small stones.
LaC----- Laidig	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Moderate: slope, wetness.	Fair: slope, small stones.
LdB----- Laidig	Severe: percs slowly, wetness, large stones.	Severe: large stones.	Severe: wetness, large stones.	Moderate: wetness.	Poor: large stones.
LdC----- Laidig	Severe: slope, percs slowly, wetness.	Severe: slope, large stones.	Severe: wetness, large stones.	Severe: slope.	Poor: slope, large stones.
LeB----- Leck Kill	Moderate: depth to rock.	Moderate: slope, seepage, depth to rock.	Severe: depth to rock.	Slight-----	Fair: thin layer, small stones.
LeC----- Leck Kill	Moderate: slope, depth to rock, wetness.	Severe: slope.	Severe: depth to rock.	Moderate: slope.	Fair: slope, thin layer, small stones.
LfC----- Leck Kill	Severe: slope.	Severe: slope.	Severe: depth to rock.	Severe: slope.	Poor: slope.

See footnotes at end of table.



TABLE 8.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
LhB----- Lehigh	Severe: percs slowly, wetness.	Moderate: slope, depth to rock.	Severe: wetness, depth to rock.	Severe: wetness.	Fair: area reclaim, too clayey, thin layer.
Ls----- Lindside	Severe: floods, wetness, percs slowly.	Severe: floods.	Severe: floods, wetness.	Severe: floods, wetness.	Good.
MaA----- Markes	Severe: percs slowly, wetness, depth to rock.	Severe: depth to rock.	Severe: wetness, depth to rock.	Severe: wetness.	Poor: wetness.
Me----- Melvin Variant	Severe: floods, wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
MoB----- Mount Lucas	Severe: percs slowly, wetness.	Moderate: slope, depth to rock.	Severe: wetness, depth to rock.	Severe: wetness.	Fair: thin layer, too clayey.
MsB----- Mount Lucas	Severe: percs slowly, wetness, large stones.	Severe: large stones.	Severe: wetness, large stones.	Severe: wetness.	Poor: large stones.
MuB----- Murrill	Slight**-----	Moderate**: seepage.	Moderate**: too clayey.	Slight**-----	Fair**: small stones.
NeB----- Neshaminy	Severe: percs slowly.	Moderate: slope, depth to rock.	Severe: depth to rock.	Slight-----	Fair: small stones.
NeC----- Neshaminy	Severe: percs slowly.	Severe: slope.	Severe: depth to rock.	Moderate: slope.	Fair: slope, small stones.
NhB----- Neshaminy	Severe: percs slowly, large stones.	Severe: large stones.	Severe: depth to rock, large stones.	Slight-----	Poor: large stones.
NhC----- Neshaminy	Severe: slope, percs slowly, large stones.	Severe: slope, large stones.	Severe: depth to rock, large stones.	Severe: slope.	Poor: slope, large stones.
NHE----- Neshaminy	Severe: slope, percs slowly, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: slope, large stones.
No----- Nolin Variant	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Good.
PeB----- Penn	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Fair: small stones.
PeC----- Penn	Severe: depth to rock.	Severe: depth to rock, slope, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Fair: slope, small stones.
Ph----- Philo	Severe: floods, wetness.	Severe: floods.	Severe: floods, seepage, wetness.	Severe: floods.	Good.

See footnotes at end of table.

TABLE 8.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Po----- Pope	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Good.
Qu*. Quarries					
ReB----- Readington	Severe: percs slowly, wetness.	Moderate: slope, depth to rock.	Severe: wetness, depth to rock.	Severe: wetness.	Fair: too clayey.
Ro----- Rowland	Severe: floods, wetness.	Severe: floods, wetness, seepage.	Severe: floods, seepage.	Severe: floods, seepage, wetness.	Fair: too clayey.
Ru*. Rubble land					
ThA----- Thorndale	Severe: wetness, percs slowly.	Slight**-----	Severe: wetness.	Severe: wetness.	Poor: wetness.
ThB----- Thorndale	Severe: wetness, percs slowly.	Moderate**: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
UnB----- Ungers	Moderate: depth to rock.	Moderate: slope, depth to rock, seepage.	Severe: depth to rock.	Slight-----	Good.
UnC----- Ungers	Moderate: depth to rock.	Severe: slope.	Severe: depth to rock.	Moderate: slope.	Fair: slope.
UnD----- Ungers	Severe: slope.	Severe: slope.	Severe: depth to rock.	Severe: slope.	Poor: slope.
JoB----- Ungers	Severe: large stones.	Severe: large stones.	Severe: large stones, depth to rock.	Slight-----	Poor: large stones.
UoC----- Ungers	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, depth to rock.	Severe: slope.	Poor: slope, large stones.
UPE*: Ungers-----	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones, depth to rock.	Severe: slope.	Poor: slope, large stones.
Calvin-----	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: seepage, slope.	Poor: large stones, slope.
UR*: Urban land.					
Berks-----	Severe: depth to rock.	Severe: slope, seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: small stones.
US*: Urban land.					
Hagerstown-----	Moderate**: slope, depth to rock.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate**: slope.	Poor: too clayey.

See footnote at end of table.

TABLE 8.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
WaA----- Watchung	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness, too clayey.
WbB----- Watchung	Severe: wetness, percs slowly.	Severe: large stones.	Severe: wetness.	Severe: wetness.	Poor: wetness, too clayey.
WeB----- Weikert	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: thin layer.
WeC----- Weikert	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: thin layer.
WeD----- Weikert	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: seepage, depth to rock.	Severe: slope, seepage.	Poor: slope, thin layer.
WeE----- Weikert	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: slope, seepage.	Poor: slope, thin layer.

\* See map unit description for the composition and behavior of the map unit.

\*\*Ground water contamination is a potential hazard because of solution channels and cavernous bedrock.

TABLE 9.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AbA, AbB----- Abbottstown	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, small stones.
BeA, BeB, BeC----- Bedington	Fair: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
BeD----- Bedington	Fair: slope, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, small stones.
BkB, BkC----- Berks	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
BkD----- Berks	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones, slope.
Bm----- Bowmansville	Poor: wetness, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
BnB, BnC----- Brecknock	Fair: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
BrA, BrB----- Brinkerton	Poor: wetness, frost action, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
BwB----- Buchanan	Poor: frost action, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
BxB----- Buchanan	Poor: frost action, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
BxC----- Buchanan	Poor: frost action, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones.
ByB----- Bucks	Fair: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
CeB, CeC----- Chester	Fair: frost action, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
ChC----- Chester	Fair: large stones, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones.
CkA, CkB----- Clarksburg	Fair: frost action, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
CmA, CmB----- Comly	Fair: low strength, frost action, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: small stones, thin layer.
DfA, DfB----- Duffield	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
DfC----- Duffield	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
Dp*. Dumps				
HaA, HaB----- Hagerstown	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
HbC----- Hagerstown	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
HeB*: Hagerstown----- Rock outcrop.	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
HeC*: Hagerstown----- Rock outcrop.	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
HHB----- Hazleton	Fair: frost action, large stones.	Poor: excess fines.	Poor: excess fines.	Poor: large stones.
HHE----- Hazleton	Poor: slope.	Poor: excess fines.	Poor: excess fines.	Poor: slope, large stones.
HLD*: Hazleton-----	Fair: slope, frost action, large stones.	Poor: excess fines.	Poor: excess fines.	Poor: slope, large stones.
Laidig-----	Fair: slope, frost action, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones.
Ho----- Holly	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
KnB, KnC----- Klinesville	Poor: thin layer.	Unsuited: excess fines.	Poor: excess fines.	Poor: small stones.
KnD----- Klinesville	Poor: thin layer.	Unsuited: excess fines.	Poor: excess fines.	Poor: slope, small stones.
LaB, LaC----- Laidig	Fair: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
LdB----- Laidig	Fair: large stones, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
LdC----- Laidig	Fair: slope, frost action, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones.

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
LeB, LeC----- Leck Kill	Fair: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
LfC----- Leck Kill	Fair: slope, frost action, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones.
LhB----- Lenigh	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
Ls----- Lindside	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
MaA----- Markes	Poor: frost action, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones, wetness.
Me----- Melvin Variant	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
MoB----- Mount Lucas	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: small stones.
MsB----- Mount Lucas	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
MuB----- Murrill	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
NeB, NeC----- Neshaminy	Fair: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
NhB----- Neshaminy	Fair: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
NhC----- Neshaminy	Fair: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
NHE----- Neshaminy	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
No----- Nolin Variant	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
PeB, PeC----- Penn	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
Ph----- Philo	Poor: frost action.	Poor: excess fines.	Unsuited: excess fines.	Good.
Po----- Pope	Fair: low strength, frost action.	Poor: excess fines.	Unsuited: excess fines.	Good.
Qu*, Quarries				
ReB----- Readington	Fair: low strength, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, small stones.
Ro----- Rowland	Poor: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, small stones.
Ru*, Rubble land				

See footnote at end of table.

TABLE 9.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
ThA, ThB----- Thorndale	Poor: frost action, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
UnB----- Ungers	Fair: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
UnC----- Ungers	Fair: frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
UnD----- Ungers	Fair: slope, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
UoB----- Ungers	Fair: frost action, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
UoC----- Ungers	Fair: slope, frost action, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones.
UPE*: Ungers-----	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones.
Calvin-----	Poor: thin layer, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones, slope, large stones.
UR*: Urban land.				
Berks-----	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
US*: Urban land.				
Hagerstown-----	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
WaA----- Watchung	Poor: wetness, low strength, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
WbB----- Watchung	Poor: wetness, low strength, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, large stones.
WeB, WeC----- weikert	Poor: thin layer.	Unsuited: excess fines.	Poor: excess fines.	Poor: small stones, thin layer.
WeD----- Weikert	Poor: thin layer.	Unsuited: excess fines.	Poor: excess fines.	Poor: slope, small stones.
WeE----- Weikert	Poor: thin layer.	Unsuited: excess fines.	Poor: excess fines.	Poor: slope, small stones.

\* See map unit description for the composition and behavior of the map unit.



TABLE 10.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
AbA, AbB----- Abbottstown	Depth to rock, slope.	Low strength, compressible, piping.	Slow refill----	Percs slowly, wetness.	Percs slowly, wetness.	Percs slowly, wetness, erodes easily.
BeA, BeB, BeC, BeD----- Bedington	Seepage-----	Low strength, compressible, piping.	No water-----	Not needed----	Slope-----	Slope.
BkB, BkC, BkD----- Berks	Depth to rock	Piping-----	No water-----	Not needed----	Depth to rock, slope.	Depth to rock, droughty, slope.
Bm----- Bowmansville	Seepage, wetness.	Piping, floods.	Favorable-----	Floods, wetness.	Not needed----	Wetness, floods.
BnB, BnC----- Brecknock	Depth to rock, slope.	Piping-----	No water-----	Not needed----	Erodes easily, slope.	Erodes easily, slope.
BrA, BrB----- Brinkerton	Slope-----	Piping, low strength.	Favorable-----	Wetness, percs slowly.	Percs slowly, erodes easily, wetness.	Percs slowly, wetness, erodes easily.
BwB----- Buchanan	Slope-----	Piping, low strength.	Deep to water	Percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
BxB, BxC----- Buchanan	Slope-----	Large stones, piping, low strength.	Deep to water, large stones.	Percs slowly, slope, large stones.	Slope, large stones, percs slowly.	Slope, large stones, percs slowly.
ByB----- Bucks	Seepage, depth to rock.	Low strength, compressible, piping.	No water-----	Not needed----	Slope-----	Slope.
CeB, CeC----- Chester	Seepage-----	Low strength, compressible, piping.	No water-----	Not needed----	Favorable-----	Favorable.
ChC----- Chester	Large stones, seepage.	Large stones, low strength, piping.	No water, large stones.	Not needed----	Large stones----	Large stones.
CkA, CkB----- Clarksburg	Slope-----	Piping, low strength.	Slope, deep to water.	Percs slowly, wetness.	Percs slowly, wetness.	Percs slowly, erodes easily.
CmA, CmB----- Comly	Depth to rock, slope.	Low strength, hard to pack.	Deep to water, depth to rock.	Wetness, slope.	Wetness, erodes easily.	Wetness, erodes easily, percs slowly.
DfA, DfB, DfC----- Duffield	Slope-----	Low strength, compressible, hard to pack.	No water-----	Not needed----	Depth to rock	Slope, erodes easily.
Dp*. Dumps						
HaA, HaB, HbC----- Hagerstown	Seepage-----	Compressible, hard to pack.	No water-----	Not needed----	Favorable-----	Favorable.
HeB*, HeC*: Hagerstown-----	Seepage-----	Compressible, hard to pack.	No water-----	Not needed----	Favorable-----	Favorable.
Rock outcrop.						

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
HHE, HHE----- Hazleton	Depth to rock, seepage.	Low strength, piping.	No water-----	Not needed-----	Slope, large stones.	Slope, large stones.
HLD*: Hazleton-----	Depth to rock, seepage.	Low strength, piping, large stones.	No water, large stones.	Not needed-----	Slope, large stones.	Slope, large stones.
Laidig-----	Seepage, slope.	Large stones, slope.	No water, large stones.	Not needed-----	Large stones, slope.	Large stones, slope.
Ho----- Holly	Seepage, wetness.	Piping, floods.	Favorable-----	Floods, wetness, poor outlets.	Not needed-----	Wetness, floods.
KnB, KnC, KnD----- Klinesville	Seepage, slope.	Seepage, thin layer.	No water-----	Not needed-----	Depth to rock, rooting depth.	Depth to rock, rooting depth, droughty.
LaB, LaC----- Laidig	Slope, seepage.	Favorable-----	No water-----	Not needed-----	Slope, rooting depth.	Slope.
LdB, LdC----- Laidig	Seepage, slope.	Large stones, slope.	No water, large stones.	Not needed-----	Large stones, slope.	Large stones, slope.
LeB, LeC----- Leck Kill	Seepage-----	Low strength, compressible, piping.	No water-----	Not needed-----	Slope-----	Slope.
LfC----- Leck Kill	Seepage-----	Low strength, compressible, piping.	No water-----	Not needed-----	Large stones, slope.	Large stones, slope.
LhB----- Lehigh	Depth to rock, slope.	Compressible, hard to pack, piping.	Depth to rock, slow refill.	Depth to rock, frost action, percs slowly.	Depth to rock, percs slowly, wetness.	Percs slowly, wetness, erodes easily.
Ls----- Landside	Seepage-----	Low strength, erodes easily, piping.	Deep to water	Floods-----	Not needed-----	Wetness.
MaA----- Markes	Depth to rock	Hard to pack, piping, thin layer.	Depth to rock, slow refill.	Percs slowly, wetness, slope.	Depth to rock, percs slowly, wetness.	Percs slowly, wetness.
Me----- Melvin Variant	Seepage, wetness.	Piping, floods.	Favorable-----	Wetness, floods.	Not needed-----	Wetness, floods.
MoB----- Mount Lucas	Slope, depth to rock, seepage.	Piping, hard to pack, low strength.	Slope, depth to rock, slow refill.	Frost action, percs slowly, wetness.	Percs slowly, wetness.	Percs slowly, wetness.
MsB----- Mount Lucas	Slope, depth to rock, seepage.	Piping, hard to pack, low strength.	Slope, depth to rock, large stones.	Frost action, percs slowly, wetness.	Percs slowly, wetness, large stones.	Percs slowly, wetness, large stones.
MuB----- Murrill	Slope-----	Piping, low strength.	No water-----	Not needed-----	Slope, erodes easily.	Slope, erodes easily.
NeB, NeC----- Neshaminy	Depth to rock, slope.	Piping, low strength.	No water-----	Not needed-----	Erodes easily, slope.	Erodes easily, slope.
NhB, NhC, NHE----- Neshaminy	Depth to rock, slope.	Piping, large stones.	No water, large stones.	Not needed-----	Large stones, slope.	Large stones, slope.
No----- Nolin Variant	Seepage-----	Piping, low strength.	No water-----	Not needed-----	Not needed-----	Not needed.
PeB, PeC----- Penn	Depth to rock, seepage.	Thin layer-----	No water-----	Not needed-----	Depth to rock	Depth to rock.

See footnote at end of table.

TABLE 10.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
Ph----- Philo	Seepage-----	Piping-----	Deep to water	Floods, poor outlets.	Not needed-----	Not needed.
Po----- Pope	Seepage-----	Piping-----	No water-----	Not needed-----	Not needed-----	Not needed.
Qu*. Quarries						
ReB----- Readington	Slope, depth to rock.	Piping, low strength, compressible.	Deep to water	Percs slowly, wetness.	Percs slowly, wetness.	Percs slowly, erodes easily.
Ro----- Rowland	Seepage, wetness.	Piping-----	Favorable-----	Wetness-----	Not needed-----	Wetness.
Ru*. Rubble land						
ThA, ThB----- Thorndale	Depth to rock, percs slowly.	Low strength, piping.	Depth to rock, wetness.	Percs slowly, wetness, poor outlets.	Wetness, piping, percs slowly.	Wetness, percs slowly, rooting depth.
UnB, UnC, UnD----- Ungers	Depth to rock, slope.	Piping-----	No water-----	Not needed-----	Erodes easily, slope.	Erodes easily, slope.
UoB, UoC----- Ungers	Depth to rock, slope.	Piping, large stones.	No water, large stones.	Not needed-----	Large stones, slope.	Large stones, slope.
UPE*: Ungers-----	Depth to rock, slope.	Piping, large stones.	No water, large stones.	Not needed-----	Large stones, slope.	Large stones, slope.
Calvin-----	Depth to rock	Piping, large stones.	No water, large stones.	Not needed-----	Depth to rock, large stones.	Depth to rock, droughty.
UR*: Urban land.						
Berks-----	Depth to rock	Piping, thin layer.	No water-----	Not needed-----	Depth to rock, slope.	Depth to rock, droughty.
US*: Urban land.						
Hagerstown-----	Seepage-----	Compressible, hard to pack.	No water-----	Not needed-----	Favorable-----	Favorable.
WaA----- Watchung	Favorable-----	Hard to pack, low strength.	Favorable-----	Wetness, percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.
WbB----- Watchung	Favorable-----	Hard to pack, low strength, large stones.	Large stones---	Wetness, percs slowly, frost action.	Large stones---	Large stones, wetness, percs slowly.
WeB, WeC, WeD, WeE----- Weikert	Seepage, slope.	Thin layer, low strength, seepage.	No water-----	Not needed-----	Depth to rock, rooting depth.	Depth to rock, rooting depth, droughty.

\* See map unit description for the composition and behavior of the map unit.

TABLE 11.--RECREATIONAL DEVELOPMENT

[Some terms that described restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AbA, AbB----- Abbottstown	Moderate: wetness, percs slowly.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
BeA, BeB----- Bedington	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.	Moderate: small stones.
BeC----- Bedington	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.	Moderate: slope, small stones.
BeD----- Bedington	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.	Severe: slope.
BkB----- Berks	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.	Moderate: depth to rock, small stones.
BkC----- Berks	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: small stones, slope.	Moderate: small stones.	Moderate: slope, depth to rock, small stones.
BkD----- Berks	Severe: slope.	Severe: slope.	Severe: small stones, slope.	Moderate: slope, small stones.	Severe: slope.
Bm----- Bowmansville	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
BnB----- Brecknock	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.	Moderate: small stones.
BnC----- Brecknock	Moderate: small stones, slope.	Moderate: small stones.	Severe: slope, small stones.	Moderate: small stones.	Moderate: small stones.
BrA, BrB----- Brinkerton	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
BwB----- Buchanan	Moderate: wetness, small stones.	Moderate: wetness, small stones.	Severe: small stones, wetness.	Moderate: wetness, small stones.	Moderate: small stones, wetness.
BxB----- Buchanan	Severe: large stones.	Moderate: wetness, large stones.	Severe: large stones, wetness.	Severe: large stones.	Severe: large stones.
BxC----- Buchanan	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.	Severe: large stones.	Severe: slope.
ByB----- Bucks	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
CeB----- Chester	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.	Moderate: small stones.
CeC----- Chester	Moderate: small stones, slope.	Moderate: small stones, slope.	Severe: slope, small stones.	Moderate: small stones.	Moderate: small stones, slope.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
ChC----- Chester	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.	Severe: large stones.	Severe: slope, large stones.
CkA, CkB----- Clarksburg	Moderate: percs slowly, wetness.	Slight-----	Moderate: percs slowly, wetness.	Slight-----	Slight.
CmA, CmB----- Comly	Moderate: wetness, percs slowly.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
DfA----- Duffield	Slight-----	Slight-----	Slight-----	Slight-----	Slight.
DfB----- Duffield	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
DfC----- Duffield	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
Dp*, Dumps					
HaA----- Hagerstown	Slight-----	Slight-----	Slight-----	Slight-----	Slight.
HaB----- Hagerstown	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
HbC----- Hagerstown	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
HeB*: Hagerstown-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
Rock outcrop.					
HeC*: Hagerstown-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Rock outcrop.					
HHB----- Hazleton	Severe: large stones.	Moderate: large stones.	Severe: small stones, large stones.	Severe: large stones.	Severe: large stones.
HHE----- Hazleton	Severe: slope, large stones.	Severe: slope.	Severe: slope, small stones, large stones.	Severe: slope, large stones.	Severe: slope.
HLD*: Hazleton-----	Severe: slope, large stones.	Severe: slope.	Severe: slope, small stones, large stones.	Severe: large stones.	Severe: slope, large stones.
Laidig-----	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones, small stones.	Severe: large stones.	Severe: slope, large stones.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Ho----- Holly	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
KnB----- Klinesville	Moderate: small stones.	Moderate: small stones.	Severe: depth to rock, small stones.	Moderate: small stones.	Moderate: small stones, depth to rock.
KnC----- Klinesville	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, depth to rock, small stones.	Moderate: small stones.	Moderate: slope, small stones, depth to rock.
KnD----- Klinesville	Severe: slope.	Severe: slope.	Severe: slope, depth to rock, small stones.	Moderate: slope, small stones.	Severe: slope.
LaB----- Laidig	Moderate: small stones, percs slowly.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.	Moderate: small stones.
LaC----- Laidig	Moderate: slope, small stones, percs slowly.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.	Moderate: slope, small stones.
LdB----- Laidig	Severe: large stones, small stones, percs slowly.	Moderate: small stones, large stones.	Severe: slope, small stones, large stones.	Severe: large stones.	Moderate: large stones, small stones.
LdC----- Laidig	Severe: slope, large stones.	Severe: slope.	Severe: slope, small stones, large stones.	Severe: large stones.	Severe: slope, large stones.
LeB----- Leck Kill	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.	Moderate: small stones.
LeC----- Leck Kill	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.	Moderate: slope, small stones.
LfC----- Leck Kill	Severe: slope.	Severe: slope.	Severe: slope, small stones, large stones.	Moderate: slope, large stones.	Severe: slope.
LhB----- Lehigh	Moderate: wetness, percs slowly.	Moderate: wetness.	Severe: slope, wetness.	Moderate: wetness.	Moderate: wetness.
Ls----- Lindside	Moderate: floods, wetness.	Moderate: floods.	Moderate: floods, wetness.	Slight-----	Moderate: floods.
MaA----- Markes	Severe: wetness.	Severe: wetness.	Severe: wetness, small stones.	Severe: wetness.	Severe: wetness.
Me----- Melvin Variant	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
MoB----- Mount Lucas	Moderate: wetness, percs slowly.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
MsB----- Mount Lucas	Severe: large stones.	Moderate: wetness, large stones.	Severe: wetness, large stones.	Severe: large stones.	Severe: large stones.
MuB----- Murrill	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.	Moderate: small stones.
NeB----- Neshaminy	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.	Severe: small stones.
NeC----- Neshaminy	Moderate: small stones, slope.	Moderate: small stones, slope.	Severe: slope, small stones.	Moderate: small stones.	Severe: small stones.
NhB----- Neshaminy	Severe: large stones.	Moderate: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.
NhC----- Neshaminy	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.	Severe: large stones.	Severe: slope, large stones.
NHE----- Neshaminy	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
No----- Nolin Variant	Severe: floods.	Moderate: floods.	Severe: floods.	Slight-----	Moderate: floods.
PeB----- Penn	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.	Moderate: depth to rock, small stones.
PeC----- Penn	Moderate: small stones, slope.	Moderate: small stones, slope.	Severe: slope, small stones.	Moderate: small stones.	Moderate: depth to rock, small stones, slope.
Ph----- Philo	Moderate: floods, wetness.	Moderate: floods.	Moderate: floods.	Slight-----	Moderate: floods.
Po----- Pope	Moderate: floods.	Moderate: floods.	Moderate: floods.	Slight-----	Moderate: floods.
Qu*, Quarries					
ReB----- Readington	Moderate: percs slowly, wetness.	Slight-----	Moderate: slope, wetness.	Slight-----	Slight.
Ro----- Rowland	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: wetness, floods.	Moderate: floods, wetness.
Ru*, Rubble land					
ThA, ThB----- Thorndale	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
UnB----- Ungers	Slight-----	Slight-----	Moderate: depth to rock, slope.	Slight-----	Slight.
UnC----- Ungers	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.

See footnote at end of table.

TABLE 11.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
UnD----- Ungers	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
UoB----- Ungers	Severe: large stones.	Moderate: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.
UoC----- Ungers	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.	Severe: large stones.	Severe: slope, large stones.
JPE*: Ungers-----	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Calvin-----	Severe: slope.	Severe: slope.	Severe: small stones, slope.	Severe: slope.	Severe: slope.
UR*: Urban land.					
Berks-----	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: small stones, slope.	Moderate: small stones.	Moderate: slope, depth to rock, small stones.
US*: Urban land.					
Hagerstown-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
WaA----- Watchung	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
WbB----- Watchung	Severe: wetness, large stones.	Severe: wetness.	Severe: wetness, large stones.	Severe: wetness, large stones.	Severe: wetness, large stones.
WeB----- Weikert	Moderate: small stones.	Moderate: small stones.	Severe: depth to rock, small stones.	Moderate: small stones.	Moderate: small stones.
WeC----- Weikert	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, depth to rock, small stones.	Moderate: small stones.	Moderate: slope, small stones.
WeD----- Weikert	Severe: slope.	Severe: slope.	Severe: slope, depth to rock, small stones.	Moderate: slope, small stones.	Severe: slope.
WeE----- Weikert	Severe: slope.	Severe: slope.	Severe: slope, depth to rock, small stones.	Severe: slope.	Severe: slope.

\* See map unit description for the composition and behavior of the map unit.



TABLE 12.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
AbA----- Abbottstown	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
AbB----- Abbottstown	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BeA----- Bedington	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BeB----- Bedington	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BeC----- Bedington	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
BeD----- Bedington	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
BkB----- Berks	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Fair	Poor	Very poor.
BkC----- Berks	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
BkD----- Berks	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
Bm----- Bowmansville	Poor	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
BnB----- Brecknock	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BnC----- Brecknock	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
BrA----- Brinkerton	Poor	Fair	Good	Fair	Fair	Good	Good	Fair	Fair	Good.
BrB----- Brinkerton	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
BwB----- Buchanan	Fair	Fair	Fair	Poor	Poor	Poor	Very poor.	Fair	Poor	Very poor.
BxB----- Buchanan	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Poor	Poor	Very poor.
BxC----- Buchanan	Very poor.	Very poor.	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
ByB----- Bucks	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CeB----- Chester	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CeC----- Chester	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ChC----- Chester	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
CkA----- Clarksburg	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
CkB----- Clarksburg	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CmA----- Comly	Good	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
CmB----- Comly	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
DfA----- Duffield	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
DfB----- Duffield	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
DfC----- Duffield	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Dp*, Dumps										
HaA, HaB----- Hagerstown	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
HbC----- Hagerstown	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
HeB*: Hagerstown-----	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Rock outcrop.										
HeC*: Hagerstown-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Rock outcrop.										
HhB----- Hazleton	Very poor.	Very poor.	Good	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
HhE----- Hazleton	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
HLD*: Hazleton-----	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Laidig-----	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Ho----- Holly	Poor	Fair	Fair	Poor	Poor	Good	Good	Fair	Poor	Good.
KnB, KnC, KnD----- Klinesville	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
LaB----- Laidig	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
LaC----- Laidig	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
LdB----- Laidig	Very poor.	Very poor.	Good	Good	Good	Poor	Very poor.	Poor	Fair	Very poor.
LdC----- Laidig	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
LeB----- Leck Kill	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
LeC----- Leck Kill	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
LfC----- Leck Kill	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
LhB----- Lehigh	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Ls----- Lindside	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
MaA----- Markes	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Me----- Melvin Variant	Poor	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
MoB----- Mount Lucas	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
MsB----- Mount Lucas	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
MuB----- Murrill	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
NeB----- Neshaminy	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
NeC----- Neshaminy	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
NhB----- Neshaminy	Very poor.	Very poor.	Good	Good	Good	Poor	Very poor.	Poor	Fair	Very poor.
NhC----- Neshaminy	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
NHE----- Neshaminy	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
No----- Nolin Variant	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PeB----- Penn	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
PeC----- Penn	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
Ph----- Philo	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Po----- Pope	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 12.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Qu*, Quarries										
ReB----- Readington	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Ro----- Rowland	Fair	Fair	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
Ru*, Rubble land										
ThA----- Thorndale	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
ThB----- Thorndale	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
UnB----- Ungers	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
UnC----- Ungers	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
UnD----- Ungers	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
UoB----- Ungers	Very poor.	Very poor.	Good	Good	Good	Poor	Very poor.	Poor	Fair	Very poor.
UoC----- Ungers	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
JPE*: Ungers-----	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Calvin-----	Very poor.	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
UR*: Urban land.										
Berks-----	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
US*: Urban land.										
Hagerstown-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
WaA----- Watchung	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
WbB----- Watchung	Very poor.	Very poor.	Fair	Fair	Fair	Poor	Very poor.	Poor	Fair	Very poor.
WeB, WeC, WeD, WeE- Weikert	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.

\* See map unit description for the composition and behavior of the map unit.

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

[illegible]

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches Pct	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
BnC----- Brecknock	0-8	Channery silt loam.	ML, CL, GM, SC	A-4, A-6	0-10	65-80	50-70	45-65	40-65	---	---
	8-35	Silt loam, clay loam, channery silt loam.	ML, SM, GM, SC	A-4, A-6, A-2, A-1	0-15	35-100	20-95	20-85	20-85	25-40	NP-13
	35-46	Silt loam, channery loam, very channery clay loam.	GM, ML, SC, GP-GM	A-4, A-2, A-1, A-6	0-20	20-90	15-90	10-85	10-75	25-40	NP-12
	46	Weathered bedrock.	---	---	---	---	---	---	---	---	---
BrA, BrB----- Brinkerton	0-8	Silt loam-----	ML, CL	A-4, A-6	0-10	90-100	85-100	85-100	75-100	---	---
	8-26	Silty clay loam, silt loam.	ML	A-4, A-5, A-6, A-7	0-10	90-100	85-100	85-100	65-100	30-45	5-15
	26-48	Silt loam, shaly loam, channery silty clay loam.	ML	A-4, A-6, A-7	0-10	75-100	75-100	65-100	55-100	30-45	5-15
	48-62	Silt loam, silty clay loam, channery silt loam.	ML, GM, SM	A-4, A-6, A-2	0-15	70-90	35-85	30-85	25-75	30-40	5-15
BwB----- Buchanan	0-8	Gravelly loam---	GM, ML, CL, SM	A-4, A-2	0-20	50-100	45-75	40-75	30-65	---	---
	8-23	Gravelly loam, silt loam, gravelly sandy clay loam.	GM, ML, CL, SM-SC	A-4, A-2, A-6, A-1	0-20	50-100	45-90	40-90	20-80	20-35	NP-11
	23-60	Gravelly loam, loam, channery clay loam.	GM, ML, CL, SM-SC	A-4, A-2, A-6, A-1	0-20	50-100	30-80	30-75	20-60	18-35	NP-12
BxB, BxC----- Buchanan	0-8	Extremely stony loam.	GM, ML, CL, SM	A-2, A-4	5-20	50-85	45-70	40-70	30-60	---	---
	8-23	Gravelly loam, silt loam, gravelly sandy clay loam.	GM, ML, CL, SM-SC	A-2, A-4, A-6, A-1	0-20	50-100	45-90	40-90	20-80	20-35	NP-11
	23-60	Gravelly loam, loam, channery clay loam.	GM, ML, CL, SM-SC	A-2, A-4, A-6, A-1	0-20	50-100	30-80	30-75	20-60	18-35	NP-12
ByB----- Bucks	0-20	Silt loam-----	ML, CL	A-4	0	95-100	90-100	70-95	60-90	23-32	3-10
	20-40	Silt loam, silty clay loam, shaly silt loam.	ML, CL, ML-CL, CH	A-4, A-5, A-6, A-7	0	85-100	80-100	75-100	60-95	28-55	7-25
	40-60	Shaly silt loam, silt loam, silty clay loam.	ML, CL, GM, SM	A-4, A-6, A-7, A-2	5-15	55-90	20-80	20-80	15-70	28-55	7-25
	60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
CeB, CeC----- Chester	0-19	Channery loam---	ML	A-4, A-5, A-6, A-7	0-15	80-100	75-100	65-90	55-75	33-47	8-12
	19-44	Silty clay loam, silt loam, channery loam.	ML, CL, SM, SC	A-4, A-5, A-6, A-7	0-10	85-100	55-100	50-95	40-70	30-50	8-17
	44-60	Loam, very channery loam.	SM, SC, ML, GM	A-2, A-1, A-4, A-7	0-30	50-100	30-100	25-95	20-65	<47	<16

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
ChC----- Chester	0-19	Extremely stony loam.	ML	A-4, A-6, A-7	5-15	80-100	75-90	65-90	55-75	33-47	8-12
	19-44	Silty clay loam, silt loam, loam.	ML, CL	A-4, A-5 A-6, A-7	0-5	85-100	80-100	70-100	50-90	30-50	8-17
	44-60	Loam, sandy loam, very channery loam.	SM, SC, ML, GM	A-2, A-1 A-4, A-7	0-30	50-100	30-100	25-95	20-65	<45	<16
CkA, CkB----- Clarksburg	0-12	Silt loam-----	ML, CL	A-4	0-5	90-100	85-100	80-95	75-90	---	---
	12-22	Loam, channery silty clay loam, gravelly silt loam.	ML-CL, ML	A-4, A-5 A-6, A-7	0-15	80-100	65-100	60-95	55-85	25-45	6-16
	22-38	Silty clay loam, channery loam, gravelly silt loam.	ML-CL, ML SM, GC	A-4, A-5 A-6, A-7	0-15	75-100	55-100	50-95	45-90	20-50	4-20
	38-81	Clay, channery loam, silty clay loam.	ML, CL, GM, CH CL	A-4, A-6, A-7, A-2	0-20	50-100	20-100	15-95	15-90	20-52	4-25
CmA, CmB----- Comly	0-9	Silt loam-----	ML	A-4	0	90-100	75-100	70-95	55-95	---	---
	9-32	Silt loam, silty clay loam, shaly loam.	CL	A-4, A-6	0-5	80-100	75-100	65-95	50-90	25-40	7-15
	32-61	Shaly loam, silt loam, very shaly loam.	GM-GC, SM-SC, CL, CL-ML	A-4, A-2, A-1	0-10	50-85	30-80	25-80	20-70	25-30	4-10
DfA, DfB, DfC----- Duffield	0-11	Silt loam-----	ML, CL, CL-ML	A-4, A-6 A-7	0	85-100	85-100	80-100	70-95	20-50	5-20
	11-51	Silty clay loam, loam, silty clay.	ML, CL, MH	A-4, A-5 A-6, A-7	0-10	65-100	60-100	55-100	55-95	30-55	8-22
	51-70	Shaly silt loam, loam, clay.	SC, MH, CH, GM	A-4, A-5 A-6, A-7	0-20	65-100	50-95	45-90	40-90	40-60	9-29
Dp*. Dumps											
HaA, HaB----- Hagerstown	0-8	Silt loam-----	ML-CL, CL	A-4, A-5 A-6, A-7	0-15	85-100	80-100	80-100	70-95	25-50	5-25
	8-60	Clay, silty clay, silty clay loam.	CH, MH, CL, ML	A-7, A-6,	0-5	85-100	80-100	75-100	75-95	33-71	13-37
HbC----- Hagerstown	0-8	Silty clay loam	ML-CL, CL	A-4, A-5 A-6, A-7	0-15	85-100	80-100	80-100	70-95	25-50	5-25
	8-60	Clay, silty clay, silty clay loam.	CH, MH, CL, ML	A-7, A-6,	0-5	85-100	80-100	75-100	75-95	33-71	13-37
HeB*: Hagerstown-----	0-8	Silt loam-----	ML-CL, CL	A-4, A-5 A-6, A-7	0-15	85-100	80-100	80-100	70-95	25-50	5-25
	8-60	Clay, silty clay, silty clay loam.	CH, MH, CL, ML	A-7, A-5, A-6	0-5	85-100	80-100	75-100	75-95	33-71	13-37
Rock outcrop.											

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	<u>In</u>				<u>Pct</u>					<u>Pct</u>	
HeC*: Hagerstown-----	0-8	Silty clay loam	ML-CL, CL	A-4, A-5	0-15	85-100	80-100	80-100	70-95	25-50	5-25
	8-60	Clay, silty clay, silty clay loam.	CH, MH, CL, ML	A-6, A-7, A-6,	0-5	85-100	80-100	75-100	75-95	33-71	13-37
Rock outcrop.											
HHE, HHE----- Hazleton	0-7	Extremely stony sandy loam.	GM, SM-SC ML	A-4, A-2	5-15	60-100	50-100	50-90	35-75	---	---
	7-23	Channery sandy loam, channery loam, loam.	GM, SM-SC ML, SC	A-2, A-4	0-50	60-85	55-80	50-70	20-55	<30	NP-8
	23-63	Channery loam, very channery sandy loam, very channery loamy sand.	GM, SM, GM-GC, SM-SC	A-2, A-1, A-4	5-50	55-80	50-75	45-65	15-50	<30	NP-8
HLD*: Hazleton-----	0-7	Extremely stony sandy loam.	GM, SM, ML	A-4, A-2	5-15	60-100	50-100	50-90	35-75	---	---
	7-23	Channery sandy loam, channery loam, loam.	GM, SM-SC ML, SC	A-2, A-4	0-50	60-85	55-80	50-70	20-55	<30	NP-8
	23-63	Channery loam, very channery sandy loam, very channery loamy sand.	GM, SM, GM-GC, SM-SC	A-2, A-1, A-4	5-50	55-80	50-75	45-65	15-50	<30	NP-8
Laidig-----	0-7	Extremely stony loam	GM-GC, SM, CL-ML, SM-SC	A-4	1-10	70-100	65-100	55-95	45-75	15-30	NP-10
	7-31	Channery loam, channery sandy clay loam, channery sandy loam.	SM, SC, CL-ML, GC	A-2, A-4, A-5	0-30	65-100	60-95	50-90	30-60	15-40	2-18
	31-80	Channery sandy clay loam, channery loam, channery sandy loam.	SC, GM-GC, CL-ML, SM	A-1, A-2, A-4, A-6	0-40	40-100	35-100	25-95	20-60	20-40	2-16
Ho----- Holly	0-7	Silt loam-----	ML	A-4	0	90-100	85-100	80-100	70-90	25-35	NP-10
	7-40	Silt loam, loam, silty clay loam.	ML, CL-ML, SM, SM-SC	A-4, A-6	0	85-100	80-100	75-95	45-85	20-40	NP-14
	40-60	Stratified sand to loam.	ML, SM, SM-SC, ML-CL	A-2, A-4	0-5	70-100	65-100	55-90	35-70	20-40	NP-10
KnB, KnC, KnD----- Klinesville	0-6	Shaly silt loam	GM, SM	A-2, A-4	0-10	25-85	15-60	10-50	6-40	---	---
	6-10	Shaly silt loam, very shaly silt loam.	GM, GP, SM, SP	A-2, A-1, A-4	0-10	25-75	15-55	10-50	4-40	20-35	NP-9
	10-14	Shaly silt loam, very shaly silt loam.	GM, GP, SM, SP	A-2, A-1	0-20	15-60	10-50	10-40	4-30	20-35	NP-7
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.



TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	<u>In</u>				<u>Pct</u>					<u>Pct</u>	
LaB, LaC----- Laidig	0-7	Channery loam---	GM, SC, ML-CL, ML, CL	A-4	0-5	65-90	55-80	50-80	35-70	20-30	1-10
	7-31	Channery loam, channery sandy clay loam, channery sandy loam.	SM, ML, CL, GM-GC	A-1, A-2, A-4, A-6	5-10	70-95	55-90	40-80	20-70	15-40	2-18
	31-80	Channery sandy clay loam, channery loam, channery sandy loam.	GC, SC, GM-GC, CL-ML	A-1, A-2, A-4, A-6	5-40	50-90	40-85	30-80	15-70	15-35	2-16
LdB, LdC----- Laidig	0-7	Extremely stony loam.	GM-GC, SM, CL-ML, SM-SC	A-2, A-4	1-10	70-100	65-100	55-95	45-75	15-30	NP-10
	7-31	Channery loam, channery sandy clay loam, channery sandy loam.	SM, GC, CL-ML, CL	A-2, A-4, A-6	0-30	65-100	60-95	50-90	30-60	15-40	2-18
	31-80	Channery sandy clay loam, channery loam, channery sandy loam.	SC, GM-GC, CL-ML, SM	A-1, A-2, A-4, A-6	0-40	40-100	35-100	25-95	20-60	20-40	2-16
LeB, LeC----- Leck Kill	0-12	Shaly silt loam	SM, ML, GM, SM	A-2, A-4	0-5	70-85	60-80	50-80	35-70	---	---
	12-48	Silt loam, channery loam, shaly silty clay loam.	GM, SC, GM-GC, CL	A-4, A-2, A-6	0-30	60-90	50-85	40-80	30-70	23-40	2-17
	48-70	Very channery silt loam, very channery clay loam, very shaly loam.	SM, GM, GP-GM	A-2, A-1	0-30	30-70	10-30	8-30	6-25	25-40	2-13
	70	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
LfC----- Leck Kill	0-12	Very stony silt loam.	ML, CL, GM, SM	A-4	3-10	75-100	65-80	55-80	40-70	---	---
	12-48	Silt loam, channery loam, shaly silty clay loam.	GM, SC, GM-GC, CL	A-4, A-2, A-6	0-30	60-90	50-85	40-80	30-70	23-40	2-17
	48-70	Very channery silt loam, very channery clay loam, very shaly loam.	SM, GP-GM, GM, SP-SM	A-2, A-1	0-30	30-70	10-30	8-30	6-25	25-40	2-13
	70	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
LhB----- Lehigh	0-7	Silt loam-----	ML	A-4	0	80-100	80-100	80-100	70-95	---	---
	7-28	Very channery silt loam, channery silty clay loam.	ML, SC, GM, GC	A-4	0-10	55-90	45-85	40-80	40-70	29-40	4-10
	28-42	Channery silt loam, very channery silty clay loam.	GM, SC, ML, CL	A-4, A-2, A-1	0-20	25-70	15-65	10-60	10-55	29-40	4-10
	42	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 Inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ls----- Lindside	0-42	Silt loam-----	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-100	55-90	25-40	2-15
	42-60	Silty clay loam, silt loam.	CL, ML	A-4, A-6	0	100	95-100	80-100	55-95	25-40	2-20
MaA----- Markes	0-7	Silt loam-----	ML	A-4	0	90-100	85-100	80-100	70-95	---	---
	7-15	Shaly silt loam, shaly loam, very shaly silty clay loam.	ML, SM, GM, MH	A-4, A-6, A-7, A-2	0-10	60-85	50-70	40-60	25-55	35-60	5-25
	15-31	Very shaly silt loam, very shaly loam, very shaly silty clay loam.	GM, SM	A-1, A-2, A-4, A-6	0-10	35-75	25-55	20-50	15-45	30-45	5-15
	31	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Me----- Melvin Variant	0-25	Silt loam-----	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	65-95	25-40	5-20
	25-60	Gravelly loam, loam, silt loam.	CL, CL-ML	A-4, A-6	0	85-100	70-100	65-100	60-95	25-40	5-20
MoB----- Mount Lucas	0-15	Silt loam-----	ML	A-4	0-5	95-100	80-100	75-95	60-90	---	---
	15-35	Silt loam, gravelly silty clay loam, sandy clay loam.	ML, GM, SM	A-4, A-2 A-6, A-7	0-10	70-95	55-95	45-95	30-90	30-49	3-15
	35-60	Gravelly clay loam, gravelly loam, gravelly loamy sand.	SP-SM, SM, ML, GM	A-2, A-4, A-6, A-1	0-10	45-80	30-70	15-70	10-55	25-40	NP-11
MsB----- Mount Lucas	0-15	Extremely stony silt loam.	ML	A-4	5-20	90-95	80-95	75-90	60-80	---	---
	15-35	Silt loam, gravelly silty clay loam, sandy clay loam.	ML, GM SM	A-4, A-2 A-6, A-7	0-10	70-95	55-95	45-95	30-90	30-49	3-15
	35-60	Gravelly clay loam, gravelly loam, gravelly loamy sand.	SP-SM, SM, ML, GM	A-2, A-4, A-6, A-1	0-10	45-80	30-70	15-70	10-55	25-40	NP-11
MuB----- Murrill	0-10	Gravelly silt loam.	ML, SM, GM, CL	A-4, A-6, A-2	0-5	50-80	35-70	35-65	30-65	30-40	5-15
	10-56	Channery silty clay loam, channery sandy clay loam, channery clay loam.	ML, CL, MH, CH	A-4, A-5 A-6, A-7	0-15	65-85	60-70	55-65	55-65	30-70	5-40
	56-62	Clay loam, clay	CH, CL	A-6, A-7	0	95-100	95-100	60-100	60-100	35-75	30-45

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
NeB, NeC----- Neshaminy	0-9	Gravelly silt loam.	ML, CL	A-4, A-6	0-10	70-90	65-80	60-75	55-65	---	---
	9-60	Silt loam, gravelly clay loam, gravelly sandy clay loam.	ML, SM, MH, GM	A-4, A-7, A-2, A-6	0-40	60-100	55-100	45-100	30-75	25-55	NP-22
	60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
NhB, NhC, NHE----- Neshaminy	0-9	Extremely stony silt loam.	ML, CL	A-4, A-6	5-15	80-100	70-100	60-100	55-85	---	---
	9-60	Silt loam, gravelly clay loam, gravelly sandy clay loam.	ML, SM, MH, GM	A-4, A-7, A-2, A-6	0-40	60-100	55-100	45-100	30-75	25-55	NP-22
	60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
No----- Nolin Variant	0-31	Silt loam-----	CL, CL-ML	A-4, A-6	0	100	90-100	85-100	80-100	25-40	5-18
	31-60	Gravelly fine sandy loam, gravelly loam.	ML, CL-ML, SM, GM-GC	A-2, A-4	0-15	65-90	45-80	40-75	30-60	<30	NP-7
PeB, PeC----- Penn	0-6	Shaly silt loam	ML, GM, SM	A-4	0-10	60-95	50-95	45-95	40-75	---	---
	6-27	Shaly silt loam, shaly loam.	ML, CL, SM, GM	A-4, A-2	0-10	55-100	50-100	45-95	30-75	20-37	1-10
	27-32	Very shaly silt loam, very shaly loam.	ML, CL, SM, GM-GC	A-4, A-2, A-1	0-15	35-100	20-100	15-95	15-70	20-35	3-10
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Ph----- Philo	0-39	Silt loam-----	ML, SM	A-4	0	95-100	80-100	70-90	45-80	20-40	1-10
	39-60	Stratified sand to silt loam.	GM, SM, ML	A-2, A-4	0	60-95	50-90	40-85	30-85	20-40	1-10
Po----- Pope	0-31	Loam-----	ML, CL, SM, SM-SC	A-4	0-5	75-100	65-100	55-95	40-90	<30	NP-10
	31-62	Fine sandy loam, sandy loam, gravelly fine sandy loam.	SM, SM-SC, ML, GM	A-2, A-1, A-4	0-5	55-100	50-100	35-95	15-70	<30	NP-7
Qu*, Quarries											
ReB----- Readington	0-17	Silt loam-----	ML	A-4	0-5	90-100	80-100	80-100	65-100	---	---
	17-32	Loam, silt loam, channery clay loam.	ML, CL, ML-CL	A-4, A-6	0-10	80-100	70-100	65-100	55-95	25-39	5-12
	32-60	Silt loam, shaly loam, shaly clay silt loam.	ML, CL, SM, GM-GC	A-2, A-4, A-6	0-10	60-95	40-90	30-85	25-55	20-35	NP-12
Ro----- Rowland	0-8	Silt loam-----	ML, SM	A-4	0-5	95-100	95-100	75-100	35-95	---	---
	8-37	Silt loam, loam, sandy clay loam.	ML, SM, CL	A-4, A-5, A-7, A-6	0-5	95-100	95-100	75-100	35-95	24-45	NP-15
	37-52	Sandy loam, silt loam, gravelly silty clay loam.	ML, SM	A-4, A-5, A-6, A-7	0-5	90-100	85-100	65-100	35-95	25-50	3-17
	52-62	Stratified sand to silt.	SM, GM, GC, SC	A-2, A-1	0-15	55-80	30-70	20-40	15-30	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	<u>In</u>				<u>Pct</u>					<u>Pct</u>	
Ru*. Rubble land											
ThA, ThB----- Thorndale	0-5	Silt loam-----	ML, CL	A-4	0-5	90-100	80-100	75-100	70-100	---	---
	5-14	Silt loam, silty clay loam.	ML, CL, ML-CL	A-4, A-6	0-5	90-100	80-100	75-100	70-100	25-40	5-12
	14-36	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0-5	85-100	80-100	70-100	70-100	25-40	5-12
	36-60	Silty clay loam, silty clay, clay.	ML, CL, ML-CL	A-4, A-5, A-6, A-7	0-5	85-100	80-100	70-100	50-100	25-45	5-15
UnB, JnC, UnD----- Ungers	0-3	Loam-----	ML, CL	A-4	0-5	90-100	85-100	85-95	60-85	---	---
	3-40	Loam, channery clay loam, very channery sandy clay loam.	GM, SM, ML	A-2, A-4	0-10	60-95	40-90	30-70	25-55	25-35	1-10
	40-60	Channery loam, very channery sandy loam.	GM, SM, GC, SM-SC	A-2, A-1	0-15	55-85	25-50	20-40	15-30	20-35	NP-11
JoB----- Ungers	0-3	Extremely stony loam.	ML, CL	A-4	5-15	85-95	80-95	75-90	60-85	---	---
	3-40	Loam, channery clay loam, very channery sandy clay loam.	GM, SM, ML	A-2, A-4	0-25	60-95	40-90	30-70	25-55	25-35	1-10
	40-60	Channery loam, very channery sandy loam.	GM, SM, GC, SM-SC	A-2, A-1	0-25	55-85	25-50	20-40	15-30	20-35	NP-11
UoC----- Ungers	0-3	Extremely stony loam.	ML, CL	A-4	5-15	80-95	80-95	75-90	60-85	---	---
	3-40	Loam, channery clay loam, very channery sandy clay loam.	GM, SM, ML	A-2, A-4	0-25	60-95	40-90	30-70	25-55	25-35	1-10
	40-60	Channery loam, very channery sandy loam.	GM, SM, GC, SM-SC	A-2, A-1	0-25	55-85	25-50	20-40	15-30	20-35	NP-11
UPE*: Ungers-----	0-3	Extremely stony loam.	ML, CL	A-4	5-15	85-95	80-95	75-90	60-85	---	---
	3-40	Loam, channery clay loam, very channery sandy clay loam.	GM, SM, ML	A-2, A-4	0-25	60-95	40-90	30-70	25-55	25-35	1-10
	40-60	Channery loam, very channery sandy loam.	GM, SM, GC, SM-SC	A-2, A-1	0-25	55-85	25-50	20-40	15-30	20-35	NP-11
Calvin-----	0-6	Shaly silt loam	ML, CL	A-4	0-15	70-95	70-90	65-90	55-75	---	---
	6-27	Shaly silt loam, channery loam, very shaly clay loam.	ML, SM, SC	A-2, A-4, A-6	0-15	50-95	45-90	40-90	30-75	22-38	NP-11
	27-40	Shaly silt loam, very shaly silt loam, very channery loam.	GM, SM, SC, GC	A-2, A-1, A-4, A-6	0-20	35-75	30-65	15-60	15-40	23-39	3-13
	40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
UR*: Urban land.											

See footnote at end of table.

TABLE 13.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
UR*: Berks-----	0-9	Shaly silt loam	GM, ML, GC, SC-SM	A-2, A-4	0-30	50-80	45-70	40-60	30-55	25-36	5-10
	9-15	Shaly loam, very shaly loam, shaly silt loam.	GM-GC, GM, SM, SC	A-1, A-2, A-4	0-30	40-80	35-70	25-60	20-45	25-36	5-10
	15-33	Shaly loam, very shaly loam, shaly silt loam.	GM, SM	A-1, A-2	0-40	35-65	25-55	20-40	15-35	24-38	2-10
	33	Weathered bedrock.	---	---	---	---	---	---	---	---	---
US*: Urban land.											
Hagerstown-----	0-8	Silty clay loam	ML-CL, CL	A-4, A-5 A-6, A-7	0-15	85-100	80-100	80-100	70-95	25-50	5-25
	8-60	Clay, silty clay, silty clay loam.	CH, MH, CL	A-7, A-5, A-6	0-5	85-100	80-100	75-100	75-95	33-7	13-37
WaA----- Watchung	0-11	Silt loam-----	ML	A-4, A-6, A-7	0-10	90-100	85-100	70-100	50-95	35-45	8-14
	11-50	Clay, silty clay, silty clay loam.	ML, CL, CH, MH	A-7	0-10	95-100	85-100	75-100	65-95	40-65	5-35
	50-62	Silt loam, silty clay loam, loam.	ML	A-4, A-5 A-6, A-7	0-25	85-100	85-90	70-90	50-85	35-45	10-15
WbB----- Watchung	0-11	Extremely stony silt loam.	ML	A-4, A-6, A-7	10-60	90-100	85-100	70-100	50-95	35-45	8-14
	11-50	Clay, silty clay, silty clay loam.	ML, CL, CH, MH	A-7	0-10	95-100	85-100	75-100	65-95	40-65	15-35
	50-62	Silt loam, silty clay loam, loam.	ML	A-4, A-5 A-6, A-7	0-25	85-100	85-90	70-90	50-85	35-45	10-15
WeB, WeC, WeD, WeE- Weikert	0-9	Shaly silt loam	GM, ML, SM	A-1, A-2, A-4	0-10	35-70	35-70	25-65	20-55	30-40	4-10
	9-17	Shaly loam, very shaly silt loam, cherty loam.	GM, GP-GM, SM, SP	A-1, A-2	0-20	15-60	10-45	5-35	5-35	28-36	3-9
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

\* See map unit description for the composition and behavior of the map unit.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors-T" apply to the entire profile. Absence of an entry means data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
AbA, AbB----- Abbottstown	0-8	0.6-2.0	0.16-0.22	3.6-5.5	Low-----	High-----	Moderate-----	0.43	3-2
	8-20	0.6-2.0	0.14-0.22	3.6-5.5	Low-----	High-----	Moderate-----	0.43	
	20-42	0.06-0.2	0.10-0.16	5.1-6.5	Low-----	High-----	Moderate-----	0.28	
	42-60	0.06-0.6	0.10-0.16	5.1-6.5	Low-----	High-----	Moderate-----	0.28	
	60	---	---	---	---	---	---	---	
BeA, BeB, BeC, BeD----- Bedington	0-9	0.6-2.0	0.12-0.16	4.5-7.3	Low-----	Low-----	High-----	0.32	4
	9-29	0.6-2.0	0.12-0.14	4.5-5.5	Low-----	Low-----	High-----	0.28	
	29-72	0.6-2.0	0.08-0.12	4.5-5.5	Low-----	Low-----	High-----	0.17	
BkB, BkC, BkD----- Berk	0-9	0.6-6.0	0.08-0.12	4.5-5.5	Low-----	Low-----	High-----	0.28	3
	9-15	0.6-6.0	0.04-0.10	4.5-5.5	Low-----	Low-----	High-----	0.17	
	15-33	2.0-6.0	0.04-0.10	4.5-6.0	Low-----	Low-----	High-----	0.17	
	33	---	---	---	---	---	---	---	
Bm----- Bowmansville	0-7	0.6-2.0	0.16-0.20	5.1-6.5	Low-----	High-----	Moderate-----	---	---
	7-40	0.2-0.6	0.16-0.20	5.1-6.5	Low-----	High-----	Moderate-----	0.28	
	40-60	2.0-6.0	0.04-0.08	5.1-7.3	Low-----	High-----	Moderate-----	0.17	
BnB----- Brecknock	0-8	0.6-2.0	0.10-0.16	4.5-6.0	Low-----	Low-----	Moderate-----	0.28	3
	8-36	0.6-2.0	0.08-0.14	4.5-6.0	Low-----	Low-----	Moderate-----	0.28	
	36-46	0.6-2.0	0.03-0.10	4.5-6.0	Low-----	Low-----	Moderate-----	0.17	
	46	---	---	---	---	---	---	---	
BnC----- Brecknock	0-8	0.6-2.0	0.10-0.16	4.5-6.0	Low-----	Low-----	Moderate-----	0.28	3
	8-35	0.6-2.0	0.08-0.14	4.5-6.0	Low-----	Low-----	Moderate-----	0.28	
	35-46	0.6-2.0	0.03-0.10	4.5-6.0	Low-----	Low-----	Moderate-----	0.17	
	46	---	---	---	---	---	---	---	
BrA, BrB----- Brinkerton	0-8	0.6-2.0	0.18-0.24	4.5-6.0	Low-----	High-----	High-----	0.43	3-2
	8-26	0.6-2.0	0.14-0.18	4.5-6.0	Moderate	High-----	High-----	0.32	
	26-48	0.06-0.2	0.08-0.12	4.5-6.0	Moderate	Moderate	Moderate	0.32	
	48-62	0.06-0.6	0.14-0.18	5.1-6.5	Low-----	Moderate	Moderate	0.20	
BwB----- Buchanan	0-8	0.6-2.0	0.12-0.18	3.6-5.5	Moderate	High-----	High-----	0.28	3-2
	8-23	0.6-2.0	0.10-0.16	3.6-5.5	Moderate	High-----	High-----	0.28	
	23-60	0.06-0.2	0.06-0.10	3.6-5.5	Moderate	High-----	High-----	0.17	
BxB, BxC----- Buchanan	0-8	0.6-2.0	0.11-0.16	3.6-5.5	Moderate	High-----	High-----	0.28	3-2
	8-23	0.6-2.0	0.10-0.16	3.6-5.5	Moderate	High-----	High-----	0.28	
	23-60	0.06-0.2	0.06-0.10	3.6-5.5	Moderate	High-----	High-----	0.17	
ByB----- Bucks	0-20	0.6-2.0	0.16-0.28	4.5-6.0	Low-----	Low-----	Moderate-----	0.32	4
	20-40	0.6-2.0	0.11-0.28	4.5-5.5	Moderate	Low-----	Moderate-----	0.43	
	40-60	0.6-2.0	0.04-0.16	4.5-5.5	Low-----	Low-----	Moderate-----	0.28	
	60	---	---	---	---	---	---	---	
CeB, CeC----- Chester	0-19	0.6-2.0	0.12-0.16	4.5-5.5	Low-----	Low-----	High-----	0.32	4
	19-44	0.6-2.0	0.10-0.14	4.5-5.5	Low-----	Low-----	High-----	0.43	
	44-60	0.6-2.0	0.08-0.12	4.5-5.5	Low-----	Low-----	High-----	0.43	
ChC----- Chester	0-19	0.6-2.0	0.12-0.16	4.5-5.5	Low-----	Low-----	High-----	0.32	4
	19-44	0.6-2.0	0.10-0.14	4.5-5.5	Low-----	Low-----	High-----	0.43	
	44-60	0.6-2.0	0.08-0.12	4.5-5.5	Low-----	Low-----	High-----	0.43	
CkA, CkB----- Clarksburg	0-12	0.6-2.0	0.14-0.20	5.1-6.5	Low-----	Moderate	Moderate	0.43	3-2
	12-22	0.6-2.0	0.12-0.18	5.1-6.5	Moderate	Moderate	Moderate	0.28	
	22-38	0.06-0.2	0.06-0.12	5.1-6.5	Moderate	Moderate	Moderate	0.28	
	38-81	0.06-0.6	0.06-0.16	5.1-6.5	Moderate	Moderate	Moderate	0.28	
CmA, CmB----- Comly	0-9	0.6-2.0	0.16-0.20	4.5-5.5	Low-----	High-----	Moderate-----	0.37	3-2
	9-32	0.6-2.0	0.12-0.16	4.5-5.5	Low-----	High-----	Moderate-----	0.28	
	32-61	0.2-2.0	0.06-0.08	5.1-6.0	Low-----	High-----	Moderate-----	0.28	

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
DfA, DfB, DfC----- Duffield	0-11	0.6-2.0	0.16-0.22	5.1-7.3	Low-----	Low-----	Moderate-----	0.32	4
	11-51	0.6-2.0	0.14-0.20	5.1-7.3	Moderate	Moderate-----	Moderate-----	0.28	
	51-70	0.6-2.0	0.14-0.20	5.1-6.5	Moderate	Moderate-----	Moderate-----	0.28	
Dp*, Dumps									
HaA, HaB, HbC----- Hagerstown	0-8	0.6-6.0	0.16-0.24	5.1-7.3	Low-----	Moderate-----	Low-----	0.32	4
	8-60	0.6-2.0	0.10-0.24	5.1-7.3	Moderate	Moderate-----	Low-----	0.28	
HeB*, HeC*:----- Hagerstown	0-8	0.6-6.0	0.16-0.24	5.1-7.3	Low-----	Moderate-----	Low-----	0.32	4
	8-60	0.6-2.0	0.10-0.24	5.1-7.3	Moderate	Moderate-----	Low-----	0.28	
Rock outcrop.									
HHB, HHE----- Hazleton	0-7	2.0-6.0	0.10-0.16	3.6-5.5	Low-----	Low-----	High-----	0.24	3-2
	7-23	2.0-20.0	0.08-0.12	3.6-5.5	Low-----	Low-----	High-----	0.17	
	23-63	2.0-20.0	0.04-0.10	3.6-5.5	Low-----	Low-----	High-----	0.17	
HLD*:----- Hazleton	0-7	2.0-6.0	0.10-0.16	3.6-5.5	Low-----	Low-----	High-----	0.24	3-2
	7-23	2.0-20.0	0.08-0.12	3.6-5.5	Low-----	Low-----	High-----	0.17	
	23-63	2.0-20.0	0.04-0.10	3.6-5.5	Low-----	Low-----	High-----	0.17	
Laidig-----	0-7	0.6-6.0	0.08-0.12	3.6-5.0	Low-----	Moderate-----	High-----	0.28	4
	7-31	0.6-6.0	0.08-0.10	3.6-5.0	Low-----	Moderate-----	High-----	0.28	
	31-80	0.2-0.6	0.06-0.10	3.6-5.0	Low-----	Moderate-----	High-----	0.17	
Ho----- Holly	0-7	0.6-2.0	0.15-0.19	5.6-7.3	Low-----	High-----	Moderate-----	---	---
	7-40	0.2-2.0	0.13-0.17	5.1-7.3	Low-----	High-----	Moderate-----	---	
	40-60	0.6-6.0	0.08-0.12	5.6-7.3	Low-----	High-----	Moderate-----	---	
KnB, KnC, KnD----- Klimesville	0-6	2.0-6.0	0.08-0.12	4.5-6.0	Low-----	Moderate-----	High-----	0.20	2
	6-10	2.0-6.0	0.06-0.10	4.5-6.0	Low-----	Moderate-----	High-----	0.28	
	10-14	2.0-6.0	0.04-0.08	4.5-6.0	Low-----	Moderate-----	High-----	0.28	
	14	---	---	---	---	---	---	---	
LaB, LaC----- Laidig	0-7	0.6-6.0	0.10-0.14	3.6-5.0	Low-----	Moderate-----	High-----	0.28	4
	7-31	0.6-6.0	0.08-0.12	3.6-5.0	Low-----	Moderate-----	High-----	0.28	
	31-80	0.2-0.6	0.06-0.10	3.6-5.0	Low-----	Moderate-----	High-----	0.17	
LdB, LdC----- Laidig	0-7	0.6-6.0	0.08-0.12	3.6-5.5	Low-----	Moderate-----	High-----	0.28	4
	7-31	0.6-6.0	0.08-0.10	3.6-5.5	Low-----	Moderate-----	High-----	0.28	
	31-80	0.2-0.6	0.06-0.10	3.6-5.5	Low-----	Moderate-----	High-----	0.17	
LeB, LeC----- Leck Kill	0-12	0.6-6.0	0.14-0.18	4.5-7.3	Low-----	Low-----	Moderate-----	0.20	3
	12-48	0.6-6.0	0.12-0.16	4.5-7.3	Low-----	Low-----	Moderate-----	0.17	
	48-70	0.6-6.0	0.04-0.08	4.5-6.0	Low-----	Low-----	Moderate-----	0.28	
	70	---	---	---	---	---	---	---	
LfC----- Leck Kill	0-12	0.6-6.0	0.14-0.20	4.5-5.5	Low-----	Low-----	Moderate-----	0.20	3
	12-48	0.6-6.0	0.12-0.16	4.5-5.5	Low-----	Low-----	Moderate-----	0.17	
	48-70	0.6-6.0	0.04-0.08	4.5-5.5	Low-----	Low-----	Moderate-----	0.28	
	70	---	---	---	---	---	---	---	
LhB----- Lehigh	0-7	0.6-2.0	0.16-0.22	5.1-6.0	Low-----	Moderate-----	Moderate-----	0.43	2-1
	7-28	0.06-0.2	0.14-0.18	5.1-6.0	Low-----	Moderate-----	Moderate-----	0.28	
	28-42	0.06-0.2	0.06-0.10	5.1-6.0	Low-----	Moderate-----	Moderate-----	0.28	
	42	---	---	---	---	---	---	---	
Ls----- Lindside	0-42	0.6-2.0	0.20-0.26	5.1-7.8	Low-----	Moderate-----	Low-----	0.28	3
	42-60	0.6-2.0	0.17-0.22	5.1-7.8	Low-----	Moderate-----	Low-----	0.28	

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
MaA----- Markes	0-7	0.6-2.0	0.14-0.18	4.5-7.3	Low-----	High-----	Moderate-----	0.43	3-2
	7-15	0.06-0.2	0.08-0.12	4.5-6.0	Low-----	High-----	Moderate-----	0.17	
	15-31	0.06-0.6	0.06-0.10	5.1-6.5	Low-----	High-----	Moderate-----	0.17	
	31	---	---	---	-----	-----	-----	---	
Me----- Melvin Variant	0-25	0.6-2.0	0.18-0.23	6.1-7.3	Low-----	High-----	Low-----	0.49	4
	25-60	0.6-2.0	0.18-0.23	6.1-7.3	Low-----	High-----	Low-----	0.37	
MoB----- Mount Lucas	0-15	0.6-2.0	0.18-0.22	5.1-6.5	Low-----	High-----	Moderate-----	0.32	3-2
	15-35	0.06-0.2	0.12-0.16	5.1-7.3	Low-----	High-----	Moderate-----	0.17	
	35-60	0.06-6.0	0.04-0.12	5.6-7.3	Low-----	High-----	Low-----	0.17	
MsB----- Mount Lucas	0-15	0.6-2.0	0.16-0.22	5.1-6.5	Low-----	High-----	Moderate-----	0.28	3-2
	15-35	0.06-0.2	0.12-0.16	5.1-7.3	Low-----	High-----	Moderate-----	0.17	
	35-60	0.06-6.0	0.04-0.12	5.6-7.3	Low-----	High-----	Low-----	0.17	
MuB----- Murrill	0-10	0.6-2.0	0.12-0.16	4.5-6.0	Low-----	Moderate-----	High-----	0.24	4
	10-56	0.6-2.0	0.10-0.14	4.5-6.0	Low-----	Moderate-----	High-----	0.1	
	56-62	0.6-2.0	0.08-0.12	4.5-6.5	Low-----	Moderate-----	Moderate-----	0.28	
NeB, NeC----- Neshaminy	0-9	0.6-2.0	0.14-0.18	5.1-6.0	Low-----	Moderate-----	Moderate-----	0.28	4
	9-60	0.2-0.6	0.10-0.14	5.1-6.0	Low-----	Moderate-----	Moderate-----	0.17	
	60	---	---	---	-----	-----	-----	---	
NhB, NhC, NHE----- Neshaminy	0-9	0.6-2.0	0.12-0.20	5.1-6.0	Low-----	Moderate-----	Moderate-----	0.28	4
	9-60	0.2-0.6	0.10-0.14	5.1-6.0	Low-----	Moderate-----	Moderate-----	0.17	
	60	---	---	---	-----	-----	-----	---	
No----- Nolin Variant	0-31	0.6-2.0	0.18-0.23	5.6-7.3	Low-----	Low-----	Moderate-----	0.43	5
	31-60	2.0-6.0	0.10-0.16	5.6-7.3	Low-----	Low-----	Moderate-----	0.43	
PeB, PeC----- Penn	0-6	0.6-6.0	0.14-0.18	3.6-5.5	Low-----	Low-----	Moderate-----	0.28	3
	6-27	0.6-6.0	0.14-0.18	3.6-5.5	Low-----	Low-----	Moderate-----	0.28	
	27-32	0.6-6.0	0.04-0.08	5.1-6.5	Low-----	Low-----	Moderate-----	0.28	
	32	---	---	---	-----	-----	-----	---	
Ph----- Philo	0-39	0.2-2.0	0.12-0.20	4.5-6.0	Low-----	Low-----	High-----	---	---
	39-60	2.0-20.0	0.06-0.10	4.5-6.0	Low-----	Low-----	High-----	---	
Po----- Pope	0-31	0.6-2.0	0.10-0.20	3.6-5.5	Low-----	Low-----	High-----	0.28	---
	31-62	0.6-6.0	0.07-0.15	3.6-5.5	Low-----	Low-----	High-----	0.28	
Qu*. Quarries									
ReB----- Readington	0-17	0.6-2.0	0.16-0.20	3.6-6.5	Low-----	Moderate-----	Moderate-----	0.43	3-2
	17-32	0.6-2.0	0.08-0.14	3.6-5.5	Low-----	Moderate-----	Moderate-----	0.43	
	32-60	0.2-0.6	0.06-0.10	5.1-6.5	Low-----	Moderate-----	Moderate-----	0.28	
Ro----- Rowland	0-8	0.6-2.0	0.14-0.18	4.5-6.0	Low-----	High-----	Moderate-----	0.43	4-3
	8-37	0.6-2.0	0.14-0.18	4.5-6.0	Low-----	High-----	Moderate-----	0.28	
	37-52	0.6-2.0	0.12-0.16	4.5-6.0	Low-----	High-----	Moderate-----	0.28	
	52-62	2.0-6.0	0.03-0.08	4.5-6.0	Low-----	High-----	Moderate-----	0.17	
Ru*. Rubble land									
ThA, ThB----- Thorndale	0-5	0.6-2.0	0.16-0.20	5.1-6.5	Low-----	High-----	High-----	0.43	3
	5-14	0.06-0.2	0.08-0.12	5.1-6.5	Low-----	Moderate-----	Moderate-----	0.28	
	14-36	0.06-0.2	0.08-0.14	5.6-7.3	Low-----	Moderate-----	Moderate-----	0.28	
	36-60	---	---	---	-----	-----	-----	---	
UnB, UnC, UnD----- Ungers	0-3	0.6-2.0	0.10-0.18	3.6-5.5	Low-----	Low-----	High-----	0.32	4
	3-40	0.6-2.0	0.10-0.14	3.6-5.5	Low-----	Low-----	High-----	0.17	
	40-60	0.6-2.0	0.06-0.12	3.6-5.5	Low-----	Low-----	High-----	0.17	

See footnote at end of table.



TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Soil reaction	Shrink- swell potential	Risk of corrosion		Erosion factors	
						Uncoated steel	Concrete	K	T
	In	In/hr	In/in	pH					
UoB----- Ungers	0-3	0.6-2.0	0.10-0.16	3.6-5.5	Low-----	Low-----	High-----	0.28	4
	3-40	0.6-2.0	0.10-0.14	3.6-5.5	Low-----	Low-----	High-----	0.17	
	40-60	0.6-2.0	0.06-0.12	3.6-5.5	Low-----	Low-----	High-----	0.17	
UoC----- Ungers	0-3	0.6-2.0	0.10-0.16	3.6-5.5	Low-----	Low-----	High-----	0.28	4
	3-40	0.6-2.0	0.10-0.14	3.6-5.5	Low-----	Low-----	High-----	0.17	
	40-60	0.6-2.0	0.06-0.12	3.6-5.5	Low-----	Low-----	High-----	0.17	
UPE*:									
Ungers-----	0-3	0.6-2.0	0.10-0.16	3.6-5.5	Low-----	Low-----	High-----	0.28	4
	3-40	0.6-2.0	0.10-0.14	3.6-5.5	Low-----	Low-----	High-----	0.17	
	40-60	0.6-2.0	0.06-0.12	3.6-5.5	Low-----	Low-----	High-----	0.17	
Calvin-----	0-6	2.0-6.0	0.10-0.16	4.5-6.0	Low-----	Low-----	Moderate-----	0.24	3-2
	6-27	2.0-6.0	0.08-0.16	4.5-6.0	Low-----	Low-----	Moderate-----	0.28	
	27-40	2.0-6.0	0.06-0.10	4.5-6.0	Low-----	Low-----	Moderate-----	0.28	
	40	---	---	---	---	---	---	---	
UR*: Urban land.									
Berks-----	0-9	0.6-6.0	0.08-0.12	4.5-5.5	Low-----	Low-----	High-----	0.28	3
	9-15	0.6-6.0	0.04-0.10	4.5-5.5	Low-----	Low-----	High-----	0.17	
	15-33	2.0-6.0	0.04-0.10	4.5-6.0	Low-----	Low-----	High-----	0.17	
	33	---	---	---	---	---	---	---	
US*: Urban land.									
Hagerstown-----	0-8	0.6-6.0	0.16-0.24	5.1-7.3	Low-----	Moderate-----	Low-----	0.32	4
	8-60	0.6-2.0	0.10-0.24	5.1-7.3	Moderate	Moderate-----	Low-----	0.28	
WaA----- Watchung	0-11	0.2-2.0	0.14-0.21	5.6-6.5	Low-----	High-----	Moderate-----	0.43	3
	11-50	<0.2	0.10-0.21	5.6-7.3	Moderate	High-----	Moderate-----	0.37	
	50-62	0.2-2.0	0.12-0.21	5.6-7.3	Moderate	High-----	Low-----	0.37	
WbB----- Watchung	0-11	0.2-2.0	0.14-0.28	5.6-6.5	Low-----	High-----	Moderate-----	0.43	3
	11-50	<0.2	0.10-0.24	5.6-7.3	Moderate	High-----	Moderate-----	0.37	
	50-62	0.2-2.0	0.12-0.24	5.6-7.3	Moderate	High-----	Low-----	0.37	
WeB, WeC, WeD, WeE- Weikert	0-9	2.0-6.0	0.08-0.14	4.5-5.5	Low-----	Moderate-----	Moderate-----	0.28	2
	9-17	2.0-6.0	0.04-0.08	4.5-5.5	Low-----	Moderate-----	Moderate-----	0.28	
	17	---	---	---	---	---	---	---	

\* See map unit description for the composition and behavior of the map unit.

TABLE 15.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "rare," "brief," and "perched." The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth <u>Fe</u>	Kind	Months	Depth <u>In</u>	Hardness	
AbA, AbB----- Abbottstown	C	None-----	---	---	0.5-1.5	Perched	Nov-Mar	40-60	Rippable	High.
BeA, BeB, BeC, BeD----- Bedington	B	None-----	---	---	>5.0	Apparent	Nov-Mar	>40	Rippable	Moderate.
BkB, BkC, BkD----- Berks	C	None-----	---	---	>6.0	---	---	20-40	Rippable	Moderate.
Bm----- Bowmansville	C	Common-----	Brief-----	Jan-May	0.0-1.5	Apparent	Sep-May	>60	---	High.
BnB, BnC----- Brecknock	B	None-----	---	---	>5.0	Apparent	Nov-Mar	40-60	Hard	Moderate.
BrA, BrB----- Brinkerton	D	None-----	---	---	0.0-0.5	Perched	Sep-Jun	>60	---	High.
BwB, BxB, BxC----- Buchanan	C	None-----	---	---	0.5-2.0	Perched	Nov-Mar	>60	---	High.
ByB----- Bucks	B	None-----	---	---	3.0-6.0	Apparent	Nov-Mar	42-60	Rippable	Moderate.
CeB, CeC----- Chester	B	None-----	---	---	>5.0	Apparent	Nov-Mar	>60	---	Moderate.
ChC----- Chester	B	None-----	---	---	>5.0	Apparent	Nov-Mar	>60	---	Moderate.
CKA, CkB----- Clarksburg	C	None-----	---	---	1.5-3.0	Perched	Nov-Mar	>60	---	Moderate.
CmA, CmB----- Comly	C	None-----	---	---	0.5-3.0	Perched	Nov-Mar	>48	Rippable	Moderate.
DfA, DfB, DfC----- Duffield	B	None-----	---	---	5.0-6.0	Apparent	Jan-Apr	>48	Rippable	Moderate.
Dp*. Dumps										
HaA, HaB, HbC----- Hagerstown	C	None-----	---	---	>6.0	---	---	>40	Hard	Moderate.
HeB*, HeC*: Hagerstown----- Rock outcrop.	C	None-----	---	---	>6.0	---	---	>40	Hard	Moderate.
HhB, HhE----- Hazleton	B	None-----	---	---	>6.0	---	---	>48	Rippable	Moderate.
HLD*: Hazleton-----	B	None-----	---	---	>6.0	---	---	>48	Rippable	Moderate.
Laidig-----	C	None-----	---	---	2.5-4.0	Perched	Jan-Mar	>60	---	Moderate.
Ho----- Holly	D	Frequent-----	Brief-----	Jan-May	0-0.5	Apparent	Dec-May	>48	Rippable	High.
KnB, KnC, KnD----- Klinesville	C/D	None-----	---	---	>6.0	---	---	10-20	Rippable	Moderate.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	
					Fe			In		
LaB, LaC, LdB, LdC----- Laidig	C	None-----	---	---	3.0-4.0	Perched	Jan-Mar	>60	---	Moderate.
LeB, LeC, LfC----- Leck Kill	B	None-----	---	---	3.0-6.0	Apparent	Nov-Apr	40-72	Rippable	Moderate.
LhB----- Lehigh	C	None-----	---	---	0.5-3.0	Perched	Nov-Mar	40-60	Hard	High.
Ls----- Lindside	C	Common-----	Brief-----	Jan-May	1.5-3.0	Apparent	Dec-Apr	>60	Hard	High.
MaA----- Markes	D	None-----	---	---	0-0.5	Apparent	Sep-May	20-40	Rippable	High.
Me----- Melvin Variant	D	Common-----	Brief-----	Jan-May	0-1.0	Apparent	Dec-May	>48	Hard	High.
MoB, MsB----- Mount Lucas	C	None-----	---	---	0.5-3.0	Perched	Nov-Mar	>48	Hard	High.
MuB----- Murrill	B	None-----	---	---	3.0-5.0	Perched	Dec-Apr	>72	---	Moderate.
NeB, NeC, NhB, NhC, NHE----- Neshaminy	B	None-----	---	---	5.0-7.0	Apparent	Nov-Mar	>48	Hard	Moderate.
No----- Nolin Variant	B	Common-----	Brief-----	Feb-May	3.0-6.0	Apparent	Feb-Mar	>40	Hard	High.
PeB, PeC----- Penn	C	None-----	---	---	4.0-6.0	Apparent	Feb-Apr	20-40	Rippable	Moderate.
Ph----- Philo	B	Common-----	Brief-----	Jan-May	1.5-3.0	Apparent	Dec-Apr	>40	Hard	High.
Po----- Pope	B	Rare to common.	Very brief	Nov-Apr	>4.0	Apparent	Feb-Mar	>60	---	Moderate.
Qu*, Quarries										
ReB----- Readington	C	None-----	---	---	1.5-2.5	Perched	Nov-Mar	>40	Rippable	Moderate.
Ro----- Rowland	C	Common-----	Brief-----	Jan-May	1.0-3.0	Apparent	Jan-Jun	>60	---	High.
Ru*, Rubble land										
ThA, ThB----- Thorndale	D	None-----	---	---	0-0.5	Apparent	Sep-May	>60	Hard	High.
UnB, JnC, UnD, UoB, UoC----- Ungers	B	None-----	---	---	>5.0	Apparent	Feb-May	>40	Rippable	Moderate.
UPE*, Ungers-----	B	None-----	---	---	>5.0	Apparent	Feb-May	>40	Rippable	Moderate.
Calvin-----	C	None-----	---	---	>6.0	---	---	20-40	Rippable	Moderate.
UR*, Urban land.										

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro- logic group	Flooding			High water table			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth <u>Fe</u>	Kind	Months	Depth <u>In</u>	Hardness	
UR*: Berks-----	C	None-----	---	---	>6.0	---	---	20-40	Rippable	Moderate.
US*: Urban land.										
Hagerstown-----	C	None-----	---	---	>6.0	---	---	>40	Hard	Moderate.
WaA, WbB----- Watchung	D	None-----	---	---	0-0.5	Apparent	Dec-Jun	>60	---	High.
WeB, WeC, WeD, WeE----- Weikert	C/D	None-----	---	---	>6.0	---	---	10-20	Rippable	Moderate.

\* See map unit description for the composition and behavior of the map unit.

TABLE 16.--SERIES ARRANGED BY PARENT MATERIAL, POSITION, AND DRAINAGE CLASS

Parent material	Somewhat excessively drained	Well drained	Moderately well drained	Somewhat poorly drained	Poorly drained	Very poorly drained
ON FLOOD PLAINS						
Reddish and brownish, acid alluvium.			Rowland--	Bowmans- ville, Rowland	Bowmans- ville	
Yellowish and brownish, acid alluvium		Pope--	Philo, Lindside			
Grayish and brownish, nonacid alluvium					Holly--	Holly--
Grayish, nonacid alluvium					Melvin Variant	
Yellowish and brownish, acid to alkaline alluvium		Nolin Variant				
ON MOUNTAINTOPS AND SLOPES						
Grayish and brownish sandstone		Hazleton--				
Mica and granitized schists and gneiss		Chester--				
Reddish shale, siltstone, and sandstone		Leck Kill				
Yellowish and brownish colluvium		Laidig--	Buchanan--	Buchanan	Brinkerton	
ON UPLANDS AND FLATS						
Colluvium from sandstone over limestone		Murrill--				
Metamorphosed shale and sandstone		Brecknock	Lehigh--	Lehigh--		
Diabase and other dark basic rocks		Neshaminy	Mount Lucas	Mount Lucas	Watchung--	
Limestone, calcareous and noncalcareous shale, and sandstone		Duffield, Hagerstown	Clarksburg		Thorndale	
Reddish shale, siltstone, and sandstone		Klines- ville <sup>3</sup> , Penn <sup>2</sup> , Calvin <sup>2</sup>	Readington	Abbott- stown		
Interbedded shale, siltstone, and sandstone		Bedington <sup>1</sup> , Berks <sup>2</sup> , Weikert <sup>3</sup>				
Yellowish and olive shale			Comly--	Comly--		
Noncalcareous, gray shale					Markes--	
Reddish and brownish shale, siltstone, and sandstone		Bucks--				
Reddish sandstone, conglomerate, and shale		Ungers--				

<sup>1</sup> Deep soil.<sup>2</sup> Moderately deep soil.<sup>3</sup> Shallow soil.

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Abbottstown-----	Fine-loamy, mixed, mesic Aeric Fragiaqualfs
Bedington-----	Fine-loamy, mixed, mesic Typic Hapludults
Berks-----	Loamy-skeletal, mixed, mesic Typic Dystrochrepts
Bowmansville-----	Fine-loamy, mixed, nonacid, mesic Aeric Fluvaquents
Brecknock-----	Fine-loamy, mixed, mesic Ultic Hapludalfs
Brinkerton-----	Fine-silty, mixed, mesic Typic Fragiaqualfs
Buchanan-----	Fine-loamy, mixed, mesic Aquic Fragiudults
Bucks-----	Fine-loamy, mixed, mesic Typic Hapludults
Calvin-----	Loamy-skeletal, mixed, mesic Typic Dystrochrepts
Chester-----	Fine-loamy, mixed, mesic Typic Hapludults
Clarksburg-----	Fine-loamy, mixed, mesic Typic Fragiudalfs
Comly-----	Fine-loamy, mixed, mesic Typic Fragiudalfs
Duffield-----	Fine-loamy, mixed, mesic Ultic Hapludalfs
Hagerstown-----	Fine, mixed, mesic Typic Hapludalfs
Hazleton-----	Loamy-skeletal, mixed, mesic Typic Dystrochrepts
Holly-----	Fine-loamy, mixed, nonacid, mesic Typic Fluvaquents
Klinesville-----	Loamy-skeletal, mixed, mesic Lithic Dystrochrepts
Laidig-----	Fine-loamy, mixed, mesic Typic Fragiudults
Leck Kill-----	Fine-loamy, mixed, mesic Typic Hapludults
Lehigh-----	Fine-loamy, mixed, mesic Aquic Hapludalfs
Lindside-----	Fine-silty, mixed, mesic Fluvaquentic Eutrochrepts
Markes-----	Loamy-skeletal, mixed, mesic Typic Ochraqualfs
Melvin Variant-----	Fine-loamy, mixed, nonacid, mesic Typic Fluvaquents
Mount Lucas-----	Fine-loamy, mixed, mesic Aquic Hapludalfs
Murrill-----	Fine-loamy, mixed, mesic Typic Hapludults
Neshaminy-----	Fine-loamy, mixed, mesic Ultic Hapludalfs
Nolin Variant-----	Coarse loamy, mixed, mesic, Dystric Fluventic Eutrochrepts
Penn-----	Fine-loamy, mixed, mesic Ultic Hapludalfs
Philo-----	Coarse-loamy, mixed, mesic Fluvaquentic Dystrochrepts
Pope-----	Coarse-loamy, mixed, mesic Fluventic Dystrochrepts
Readington-----	Fine-loamy, mixed, mesic Typic Fragiudalfs
Rowland-----	Fine-loamy, mixed, mesic Fluvaquentic Dystrochrepts
Thorndale-----	Fine-silty, mixed, mesic Typic Fragiaqualfs
Ungers-----	Fine-loamy, mixed, mesic Typic Hapludults
Watchung-----	Fine, mixed, mesic Typic Ochraqualfs
Weikert-----	Loamy-skeletal, mixed, mesic Lithic Dystrochrepts



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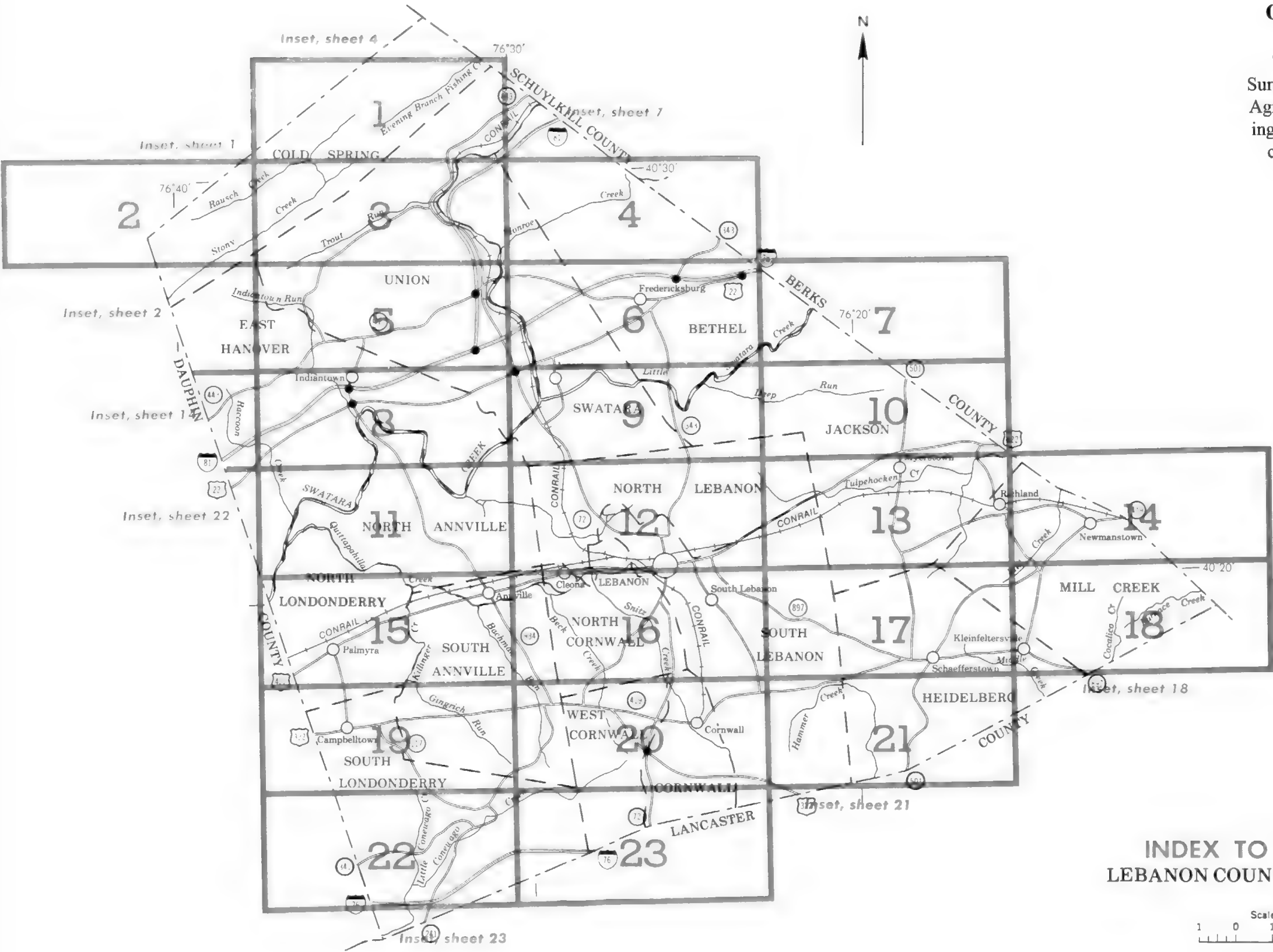
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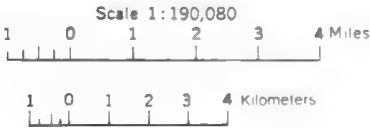


Original text from each individual map sheet read:

This map is compiled on 1977 U.S. Geological Survey Orthophotography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



INDEX TO MAP SHEETS  
LEBANON COUNTY, PENNSYLVANIA



SOIL LEGEND

The publication symbols are numeric. Soil map unit names without a slope phase are either nearly level or are miscellaneous areas

NUMERICAL LIST

SYMBOL	NAME
2	Albany fine sand
3	Beaches
4	Dirego and Bayvi soils, tidal
5	Aquents, nearly level
6	Blanton fine sand, 0 to 5 percent slopes
7	Bohicket and Tisonia soils, tidal
8	Ridgewood sand, 0 to 5 percent slopes
9	Chaires sand
10	Corolla sand, 0 to 5 percent slopes
11	Dorovan-Pamlico complex, depressional
12	Lynchburg loamy fine sand
13	Hurricane sand
14	Harbeson mucky loamy sand, depressional
15	Ortega fine sand, 0 to 5 percent slopes
16	Bonsai mucky fine sand, frequently flooded
17	Kershaw sand, 2 to 5 percent slopes
18	Kershaw sand, 5 to 12 percent slopes
19	Kureb fine sand, 3 to 8 percent slopes
20	Lynn Haven sand
21	Leefield sand
22	Leon sand
23	Maurepas muck, frequently flooded
24	Mandarin fine sand
25	Chowan, Bnckyard, and Kenner soils, frequently flooded
26	Duckston sand, occasionally flooded
27	Pelham fine sand
28	Plummer fine sand
29	Resota fine sand, 0 to 5 percent slopes
30	Rutlege loamy fine sand, depressional
31	Rutlege fine sand
32	Sapelo fine sand
33	Scranton fine sand
34	Surrency fine sand
35	Stilson fine sand
36	Pickney-Pamlico complex, depressional
37	Tooles-Meadowbrook complex, depressional
38	Meadowbrook sand
39	Scranton sand, slough
40	Newhan-Corolla complex, rolling
41	Pamlico-Pickney complex, frequently flooded
42	Meadowbrook, Meggett, and Tooles soils, frequently flooded
43	Meadowbrook sand, slough
44	Tooles sand
45	Wehadkee-Meggett complex, frequently flooded
46	Duckston-Rutlege-Corolla complex
47	Duckston Bohicket-Corolla complex
48	Udorthents, nearly level

ALHABETICAL LIST

SYMBOL	NAME
2	Albany fine sand
5	Aquents, nearly level
3	Beaches
6	Blanton fine sand, 0 to 5 percent slopes
7	Bohicket and Tisonia soils, tidal
16	Bonsai mucky fine sand, frequently flooded
9	Chaires sand
25	Chowan, Bnckyard, and Kenner soils, frequently flooded
10	Corolla sand, 0 to 5 percent slopes
4	Dirego and Bayvi soils, tidal
11	Dorovan-Pamlico complex, depressional
47	Duckston-Bohicket-Corolla complex
46	Duckston-Rutlege-Corolla complex
26	Duckston sand, occasionally flooded
14	Harbeson mucky loamy sand, depressional
13	Hurricane sand
17	Kershaw sand, 2 to 5 percent slopes
18	Kershaw sand, 5 to 12 percent slopes
19	Kureb fine sand, 3 to 8 percent slopes
21	Leefield sand
22	Leon sand
12	Lynchburg loamy fine sand
20	Lynn Haven sand
24	Mandarin fine sand
23	Maurepas muck, frequently flooded
42	Meadowbrook, Meggett, and Tooles soils, frequently flooded
38	Meadowbrook sand
43	Meadowbrook sand, slough
40	Newhan-Corolla complex, rolling
15	Ortega fine sand, 0 to 5 percent slopes
41	Pamlico-Pickney complex, frequently flooded
27	Pelham fine sand
36	Pickney-Pamlico complex, depressional
28	Plummer fine sand
29	Resota fine sand, 0 to 5 percent slopes
8	Ridgewood sand, 0 to 5 percent slopes
31	Rutlege fine sand
30	Rutlege loamy fine sand, depressional
32	Sapelo fine sand
33	Scranton fine sand
39	Scranton sand, slough
35	Stilson fine sand
34	Surrency fine sand
37	Tooles-Meadowbrook complex, depressional
44	Tooles sand
48	Udorthents, nearly level
45	Wehadkee-Meggett complex, frequently flooded

CONVENTIONAL AND SPECIAL  
SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES	
National, state, or province	— — — — —
County or pansh	— — — — —
Minor civil division	- - - - -
Reservation (national forest or park, state forest or park, and large airport)	— . — — —
Land grant	— — — — —
Limit of soil survey (label)	— — — — —
Field sheet matchline and neatline	— — — — —
AD HOC BOUNDARY (label)	— — — — —
Small airport, airfield, park, oilfield cemetery, or flood pool	
STATE COORDINATE TICK	— — — — —
LAND DIVISION CORNER (sections and land grants)	— — — — —
ROADS	
Divided (median shown if scale permits)	==
Other roads	— — — — —
Trail	- - - - -
ROAD EMBLEM & DESIGNATIONS	
Interstate	
Federal	
State	
County, farm or ranch (Other)	
RAILROAD Name only	— + — + — + —
POWER TRANSMISSION LINE (normally not shown)	. . . . .
PIPE LINE (normally not shown)	— — — — —
FENCE (normally not shown)	— — — — —
LEVEES	
Without road	— — — — —
With road	— — — — —
With railroad	— + — + — + —
DAMS	
Large (to scale)	
Medium or Small	
PITS	
Gravel pit	
Mine or quarry	

MISCELLANEOUS CULTURAL FEATURES

Farmstead, house (omit in urban area)	
Church Outside Urban Areas	
School	
Indian mound (label)	
Located object (label)	
Tank (label)	
Wells, oil or gas	
Windmill	
Kitchen midden	

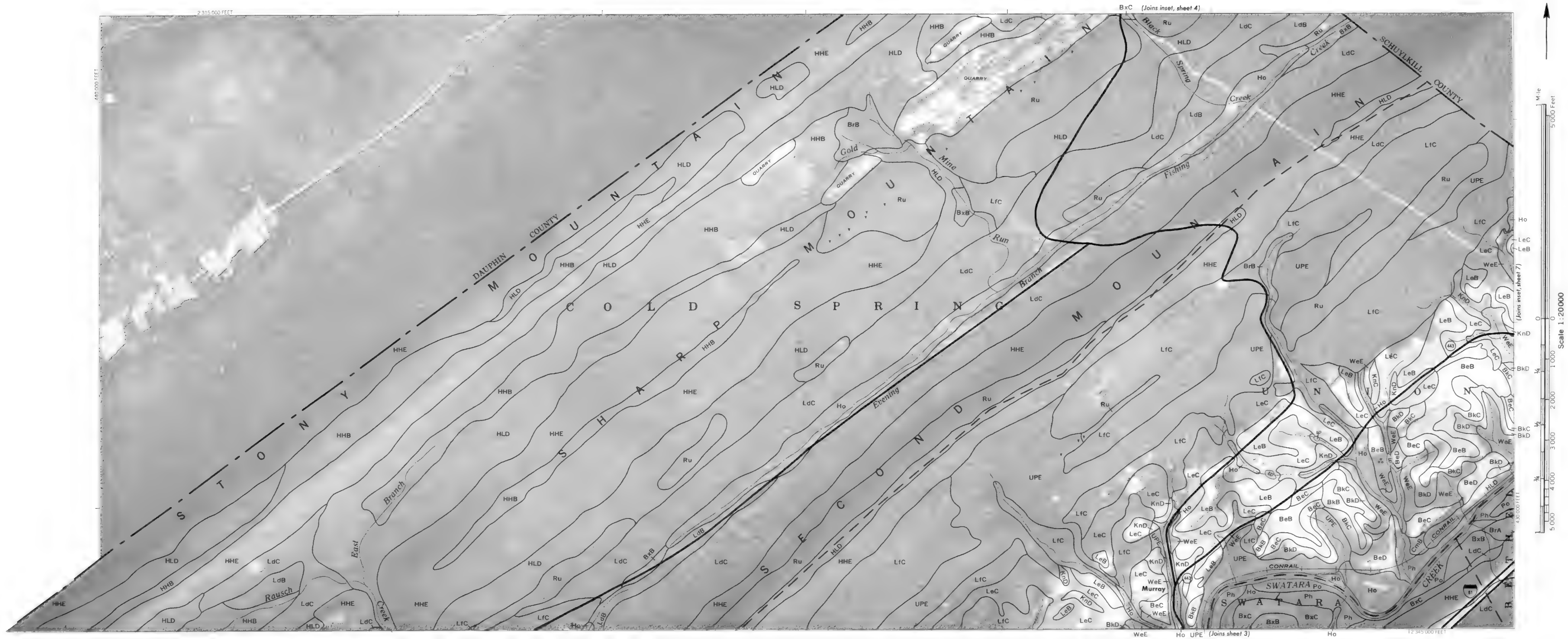
WATER FEATURES

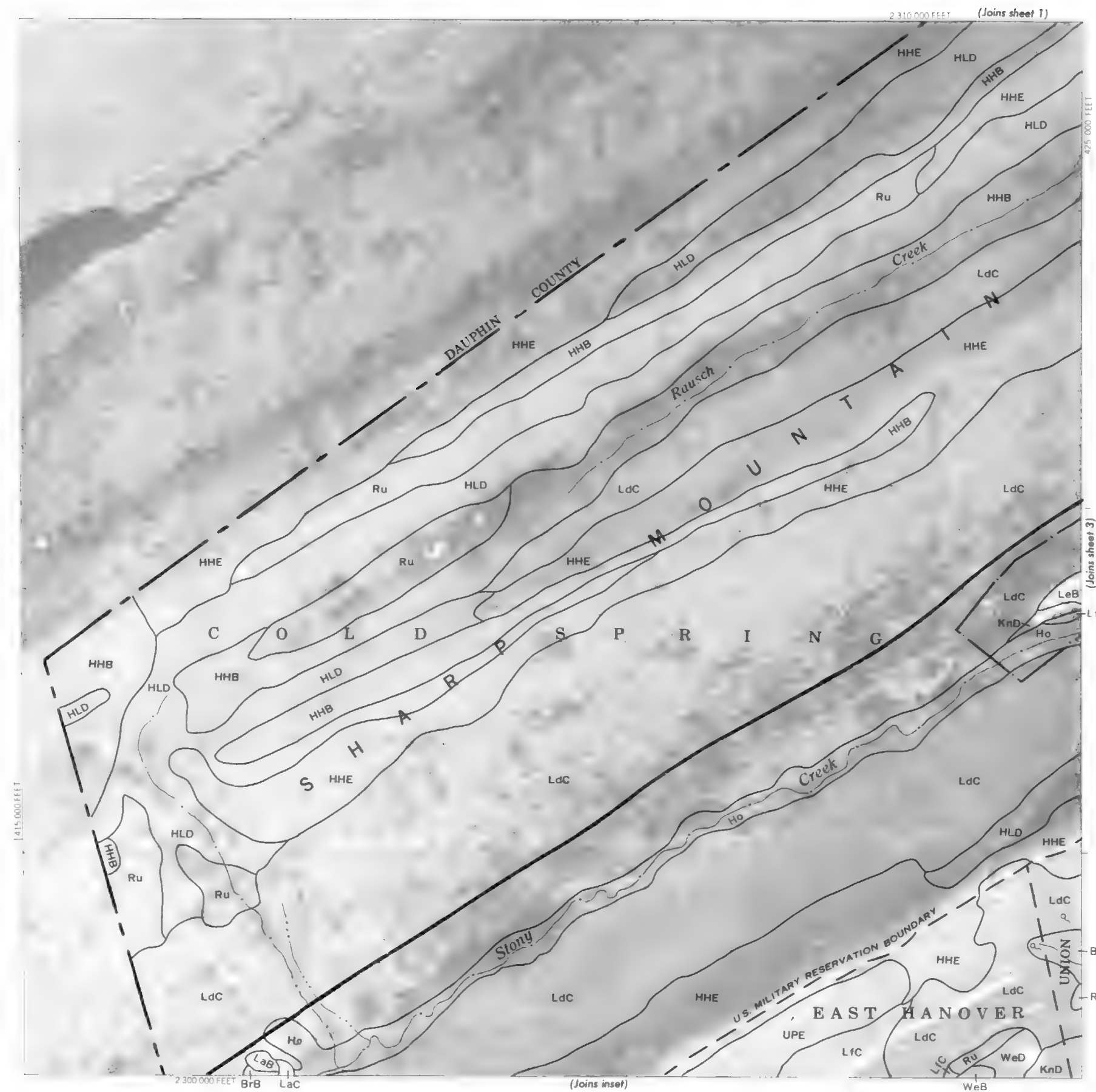
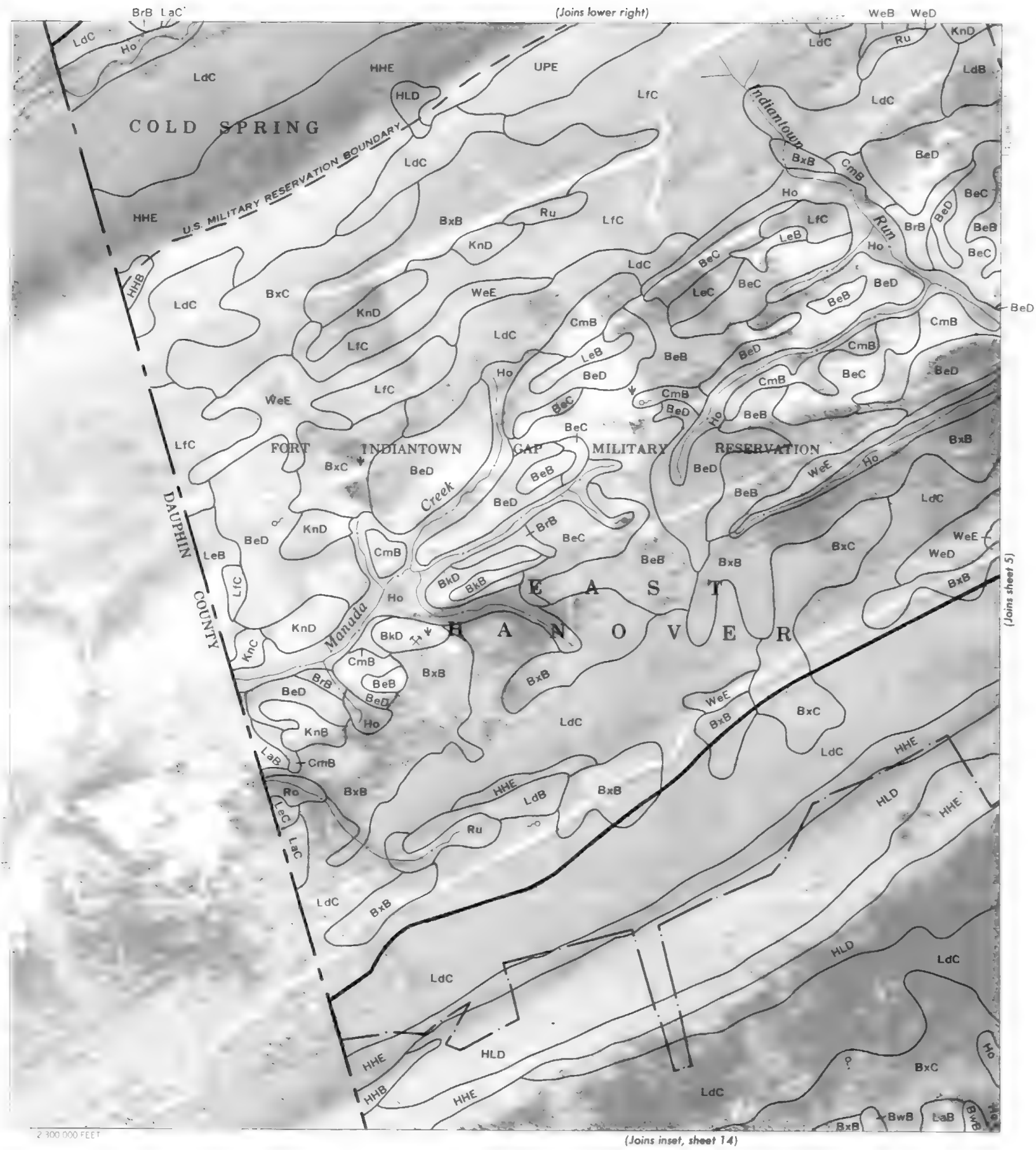
DRAINAGE	
Perennial, double line	
Perennial, single line	
Intermittent	
Drainage end	
Canals or ditches	
Double line (label)	
Drainage and/or irrigation	
LAKES, PONDS AND RESERVOIRS	
Perennial	
Intermittent	
MISCELLANEOUS WATER FEATURES	
Marsh or swamp	
Spring	
Well, artesian	
Well, irrigation	
Wet spot	

SPECIAL SYMBOLS FOR  
SOIL SURVEY

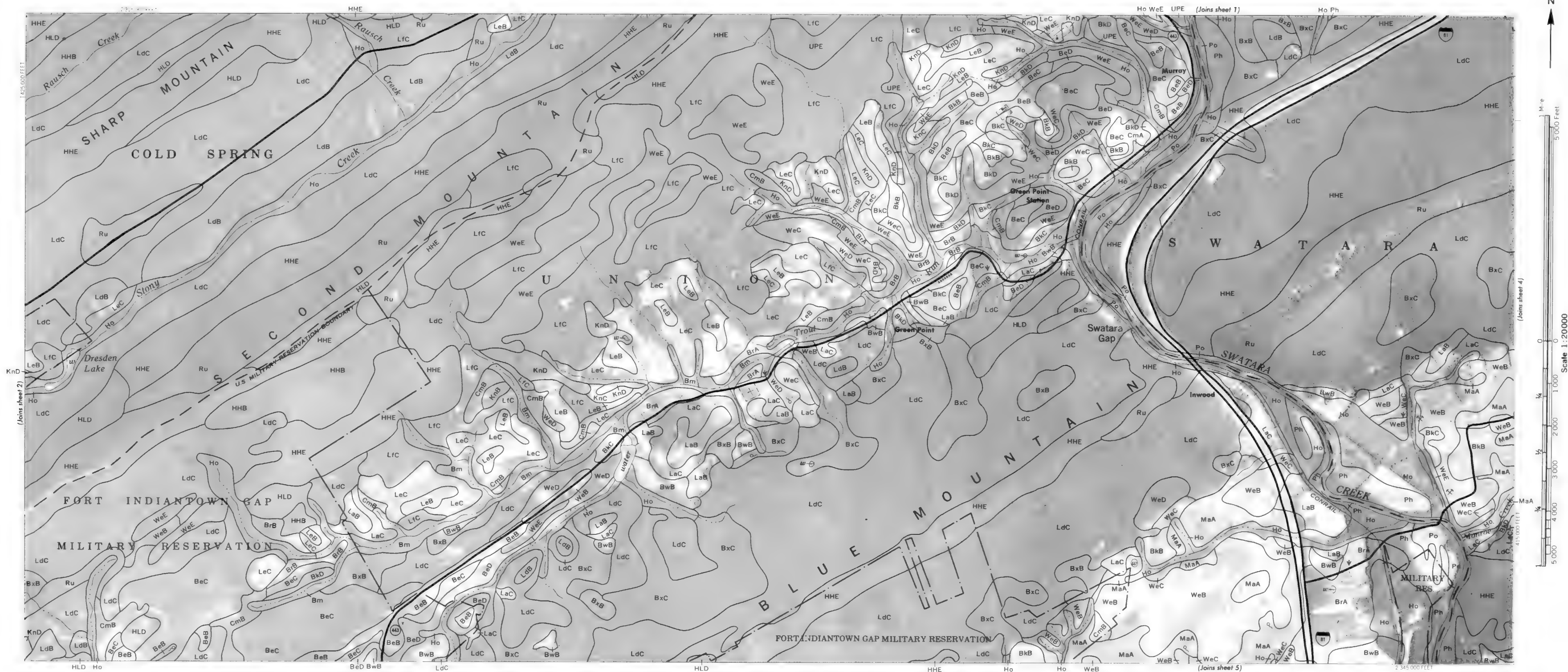
SOIL DELINEATIONS AND SYMBOLS	
ESCARPMENTS	
Bedrock (points down slope)	vvvvvvvv
Other than bedrock (points down slope)	*****
SHORT STEEP SLOPE	.....
GULLY	~~~~~
DEPRESSION OR SINK	
SOIL SAMPLE (normally not shown)	
MISCELLANEOUS	
Blowout	
Clay spot	
Gravelly spot	
Gumbo, slick or scabby spot (sodic)	
Dumps and other similar non soil areas	
Prominent hill or peak	
Rock outcrop (includes sandstone and shale)	
Saline spot	
Sandy spot	
Severely eroded spot	
Slide or slip (tips point upslope)	
Stony spot, very stony spot	









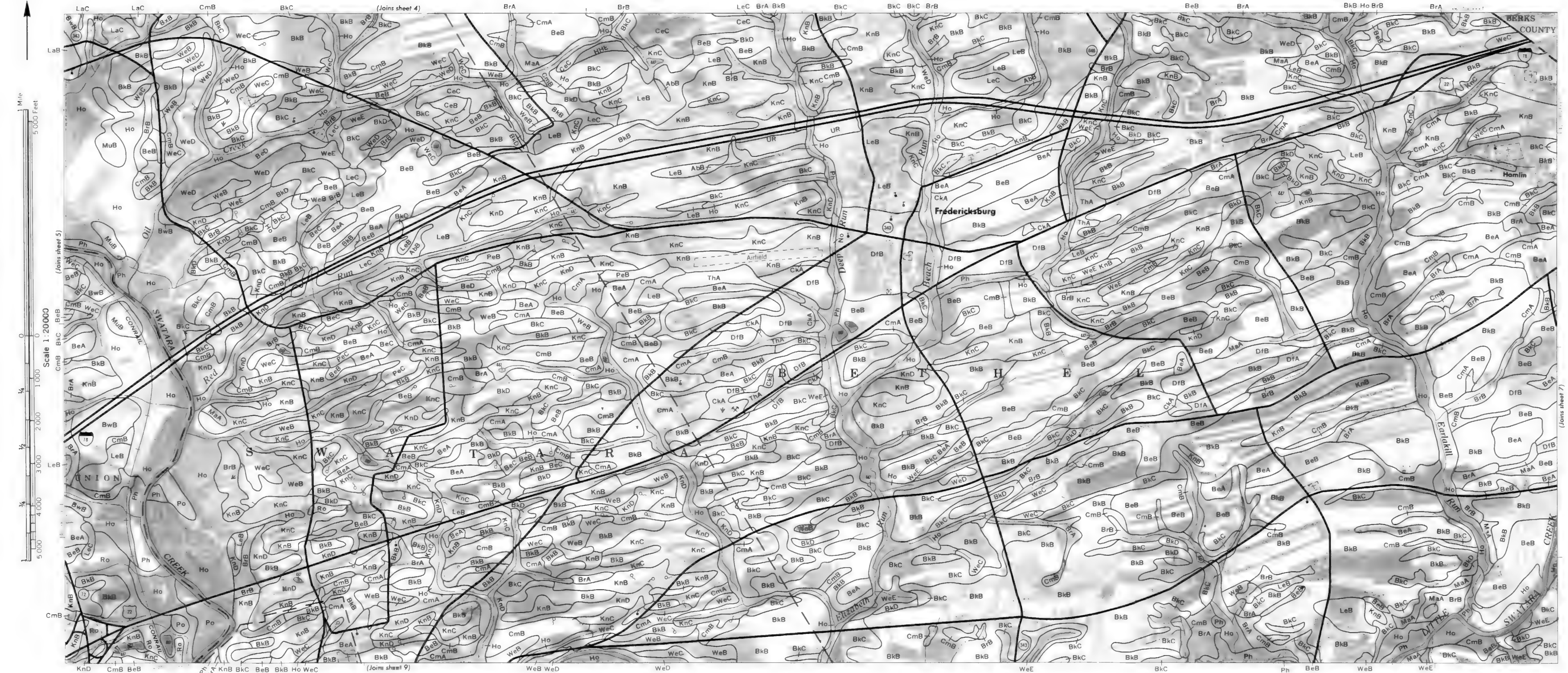




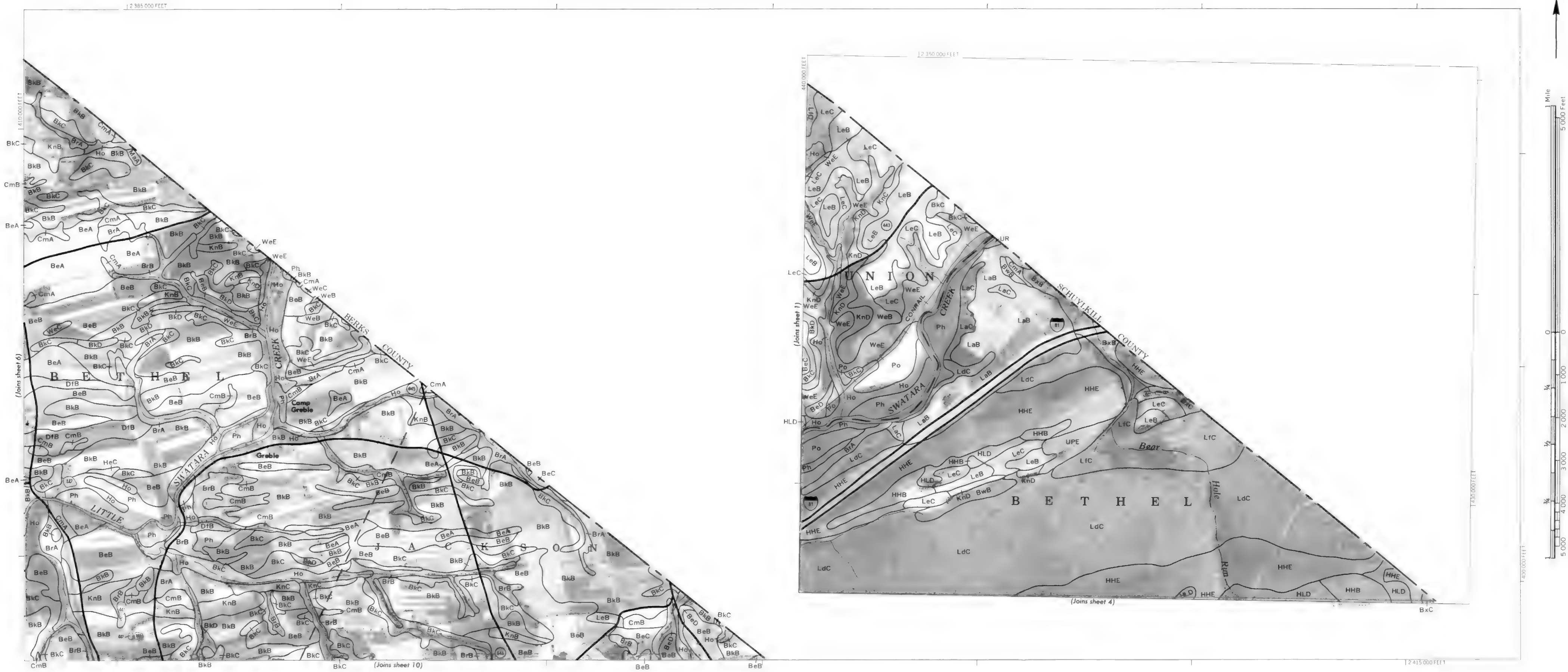


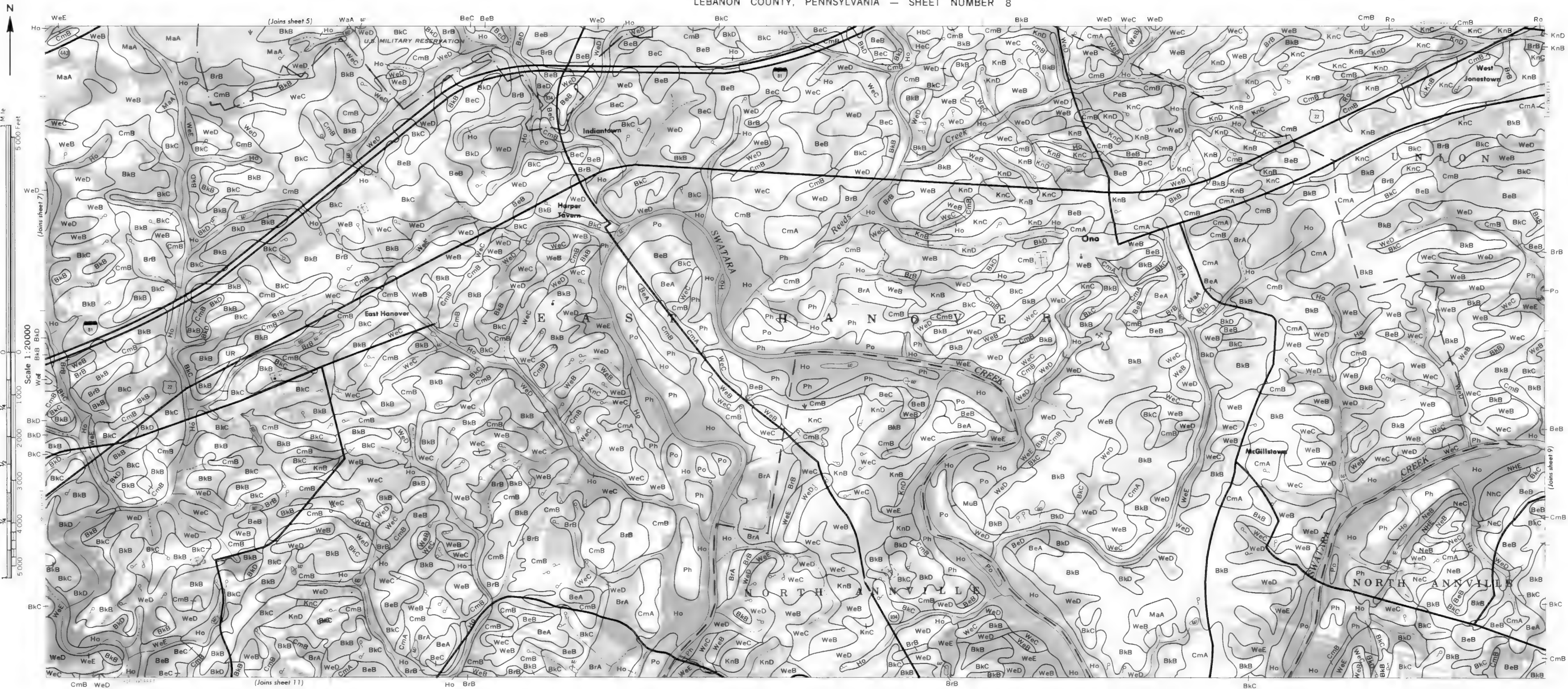




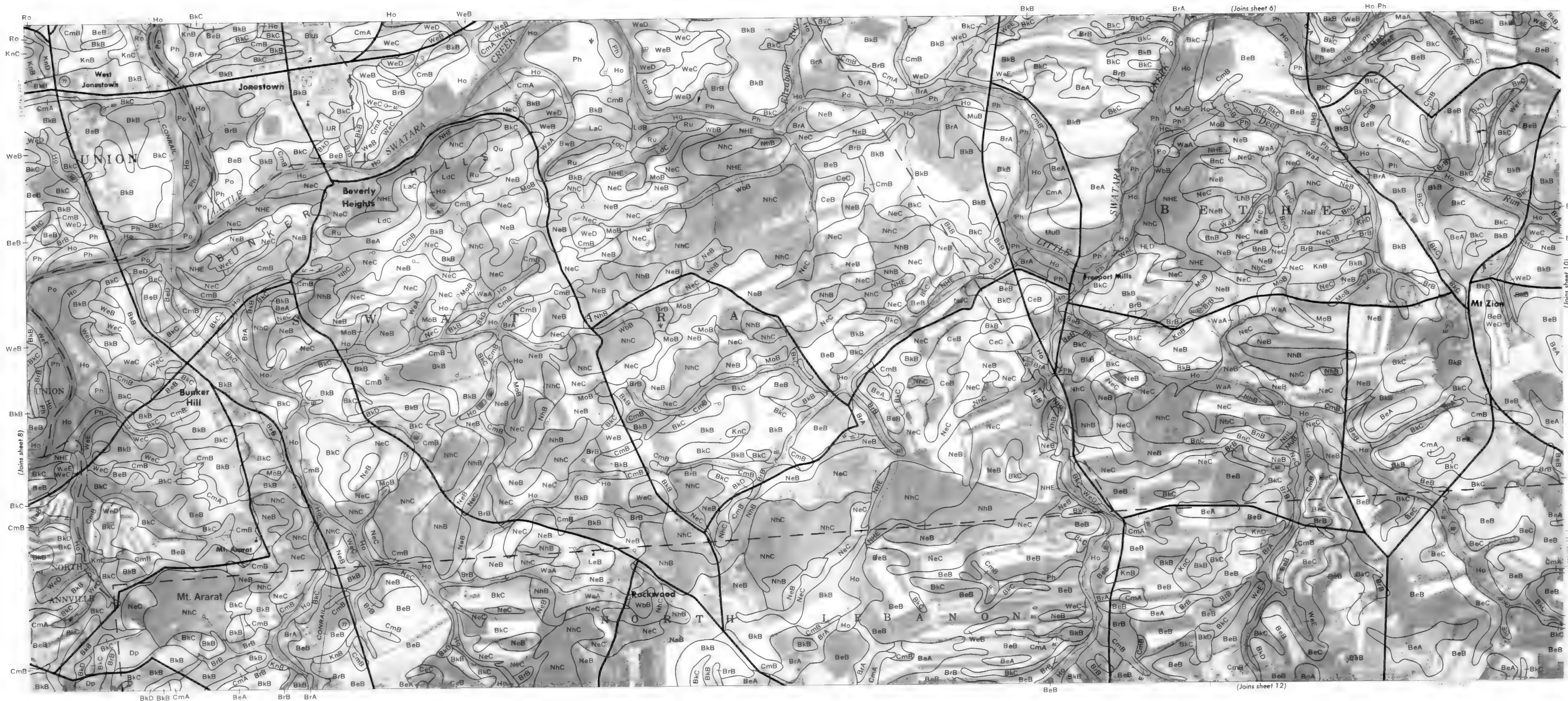




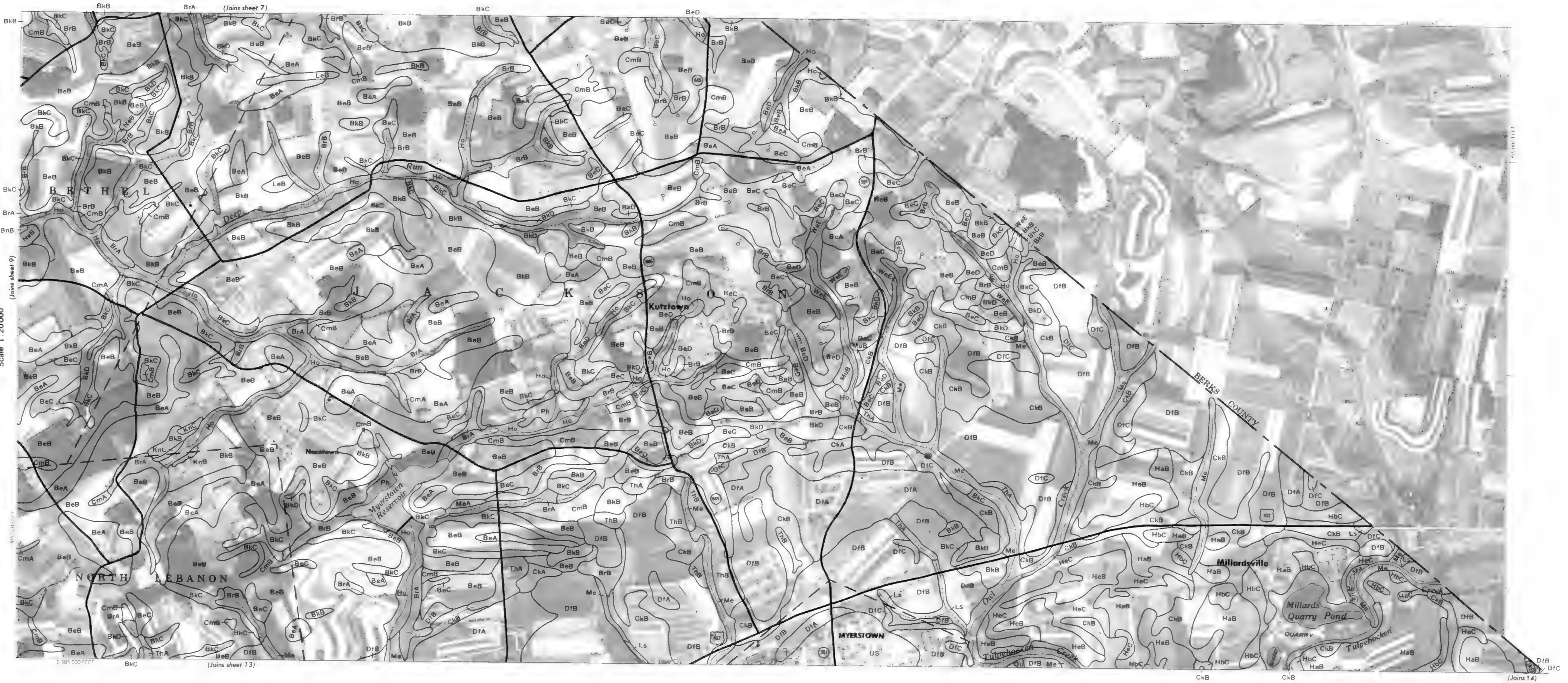
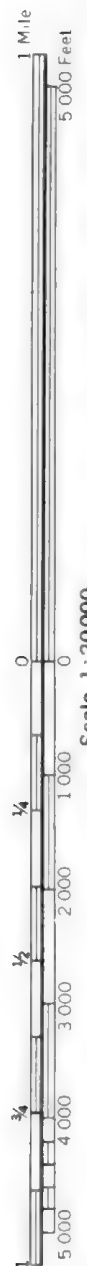












(Joins sheet 13)

(Joins 14)









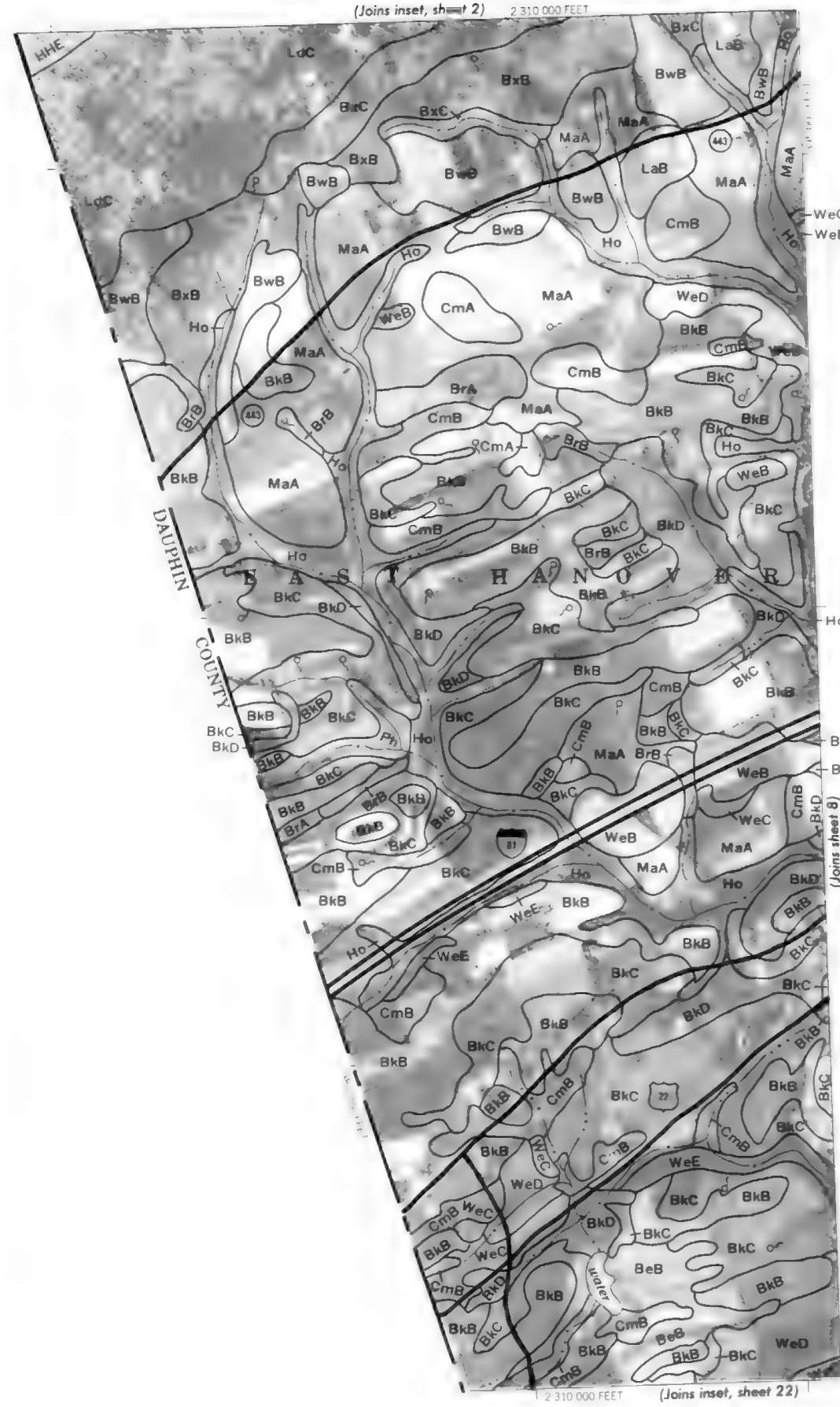








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Scale 1:20,000

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(Joins sheet 20)







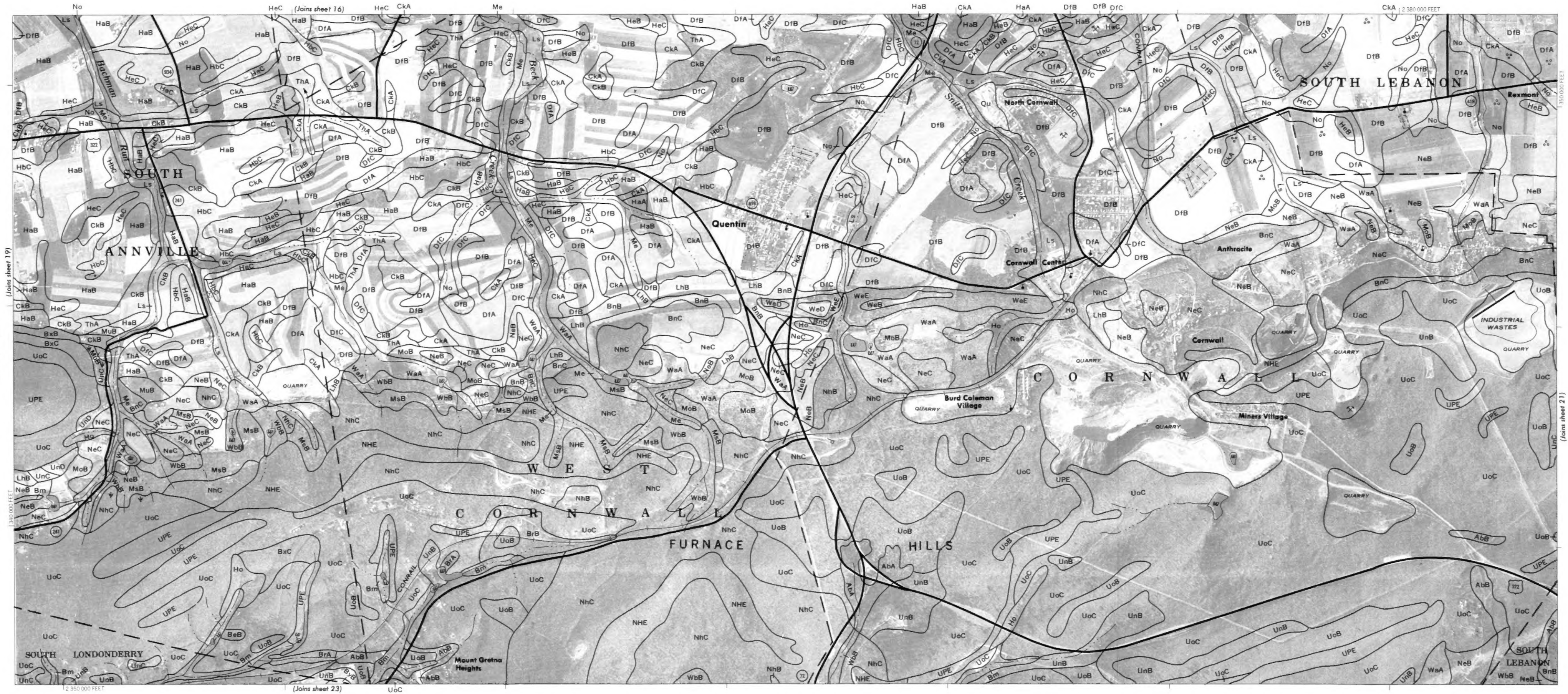
















Scale 1:20000





Scale 1:20000

LEBANON COUNTY, PENNSYLVANIA — SHEET NUMBER 22

